



Allen-Bradley

Ultra3000 Digital Servo Drives

(Catalog Numbers
2098-DSD-005, -010, and -020
2098-DSD-xxxX
2098-DSD-xxx-SE
2098-DSD-xxx-DN
2098-DSD-xxxX-DN

2098-DSD-030, -075, and -150
2098-DSD-xxxX
2098-DSD-xxx-SE
2098-DSD-xxx-DN
2098-DSD-xxxX-DN

2098-DSD-HV030, -HV050, -HV100, -HV150,
and -HV220
2098-DSD-HVxxxX
2098-DSD-HVxxx-SE
2098-DSD-HVxxx-DN
2098-DSD-HVxxxX-DN)

Integration Manual

**Rockwell
Automation**

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley® does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Preface	Introduction	P-1
	Who Should Use this Manual	P-1
	Purpose of this Manual	P-1
	Contents of this Manual	P-2
	Related Documentation	P-2
	Conventions Used in this Manual	P-3
	Product Receiving and Storage Responsibility	P-3
	Allen-Bradley Support	P-3
	Local Product Support	P-4
	Technical Product Assistance	P-4
	 Chapter 1	
Commissioning Your Ultra3000	Chapter Objectives.	1-1
	General Startup Precautions	1-1
	Before You Begin	1-2
	Configuring Your Ultra3000 and Ultra3000 with Indexing	1-2
	Front Panel Connections	1-3
	Applying Power To Your Ultra3000 Drive	1-7
	Detecting Your Ultra3000 Drive.	1-8
	Selecting a Motor	1-9
	Tuning Your Motor.	1-10
	Testing Your Motor (Non-Indexing Move)	1-11
	Testing Your Motor (Indexing Move).	1-13
	Configuring Your Ultra3000 Drive/ControlLogix Servo Module	1-15
	Configuring Your Ultra3000 with SERCOS interface	1-23
	Front Panel Connections	1-23
	Configuring Your Ultra3000 with SERCOS interface	1-28
	Configuring Your 1756-M08SE SERCOS interface Module	1-30
	Applying Power To Your Ultra3000 with SERCOS	1-34
	Testing and Tuning Your Axes	1-36
	Configuring Your Ultra3000 with DeviceNet	1-39
	Front Panel Connections	1-39
	Configuring Your Ultra3000 with DeviceNet	1-43
	Applying Power To Your Ultra3000 with DeviceNet.	1-44
	 Chapter 2	
Troubleshooting Your Ultra3000	Chapter Objectives.	2-1
	Maintaining the Drive	2-1
	Periodic Maintenance	2-1
	General Troubleshooting	2-2
	Error Codes	2-2
	Troubleshooting for SERCOS Drives	2-7
	SERCOS Module Status LED	2-7
	SERCOS Network Status LED.	2-7
	Troubleshooting for DeviceNet Drives	2-8

DeviceNet Module Status LED 2-8

DeviceNet Network Status LED 2-8

Node Problems. 2-9

Device Failure - LED Status Check. 2-9

Scanner Problems 2-10

Power Supply Problems 2-10

Cable Installation and Design Problems 2-11

Adjusting the Physical Network Configuration 2-11

Interconnect Diagrams

Appendix A

Chapter Objectives. A-1

Ultra3000 to ControlLogix Cable and Interconnect Diagrams A-1

Ultra3000 Drive and Motor Cable Combinations A-3

Ultra3000 Connector Pin-outs A-4

Preface

Introduction

Read this preface to familiarize yourself with the rest of the manual. This preface contains the following topics:

- Who should use this manual
- Purpose of this manual
- Contents of this manual
- Related documentation
- Conventions used in this manual
- Product receiving and storage responsibility
- Allen-Bradley support

Who Should Use this Manual

This manual is intended for engineers or programmers directly involved in the operation, field maintenance, and integration of the Ultra3000™ with the 1756-M08SE SERCOS interface™ module or 1756-M02AE motion module.

If you do not have a basic understanding of the Ultra3000, contact your local Allen-Bradley representative for information on available training courses before using this product.

Purpose of this Manual

This manual provides the startup, configuration, and troubleshooting procedures for the Ultra3000 Digital Servo Drives (DSD). The purpose of this manual is to assist you in the integration of your Ultra3000 with the 1756-M08SE SERCOS interface module or 1756-M02AE motion module.

Contents of this Manual

Refer to the following listing for the descriptive contents of this installation manual.

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Commissioning Your Ultra3000	Provides steps to follow when configuring your Ultra3000 and when applying power to the Ultra3000 for the first time.
2	Troubleshooting Your Ultra3000	Provides diagnostic aids that help isolate problems with your drive.
Appendix A	Interconnect Diagrams	Provides interconnect diagrams for the Ultra3000.

Related Documentation

The following documents contain additional information concerning related Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley office or distributor.

For:	Read This Document:	Catalog Number:
The instructions needed for the installation and wiring of the Ultra3000	<i>Ultra3000 Digital Servo Drives Installation Manual</i>	2098-IN003x-EN-P
Ultraware™ Installation Instructions	<i>Ultraware CD Installation Instructions</i>	2098-IN002x-EN-P
Information on configuring your Ultra3000 using Ultraware	<i>Ultraware User Manual</i>	2098-UM001x-EN-P
More detailed information on the use of ControlLogix™ motion features and application examples	<i>ControlLogix Motion Module Programming Manual</i>	1756-RM086x-EN-P
ICP 8 Axis SERCOS interface module installation instructions	<i>ICP 8 Axis SERCOS interface Module Installation Instructions</i>	1756-IN572x-EN-P
The instructions needed to program a motion application	<i>Logix5000 Controller Motion Instruction Set Reference Manual</i>	1756-RM007x-EN-P
Information on configuring and troubleshooting your ControlLogix motion module	<i>ControlLogix Motion Module Setup and Configuration Manual</i>	1756-UM006x-EN-P
Information on communicating with the Ultra3000 using DeviceNet™	<i>Ultra3000 DeviceNet Reference Manual</i>	2098-RM001x-EN-P
Information on attaching Ultra3000 drives to a DeviceNet network	<i>DeviceNet Cable System Planning and Installation Manual</i>	DN-6.7.2

Conventions Used in this Manual

The following conventions are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps
- Numbered lists provide sequential steps or hierarchical information
- Words that you type or select appear in **bold**
- When we refer you to another location, the section or chapter name appears in *italics*

Product Receiving and Storage Responsibility

You, the customer, are responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. If any items are obviously damaged, it is your responsibility to refuse delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Store the product in its shipping container prior to installation. If you are not going to use the equipment for a period of time, store using the following guidelines.

- Use a clean, dry location
- Maintain an ambient temperature range of -40 to 70° C (-40 to 158° F)
- Maintain a relative humidity range of 5% to 95%, non-condensing
- Store it where it cannot be exposed to a corrosive atmosphere
- Store it in a non-construction area

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in the chapter *Troubleshooting Your Ultra3000* first, then call your local Allen-Bradley representative or Rockwell Automation Technical Support at (440)-646-5800. For the quickest possible response, please have the catalog numbers of your products available when you call.

Commissioning Your Ultra3000

Chapter Objectives

This chapter provides you with information to apply power and configure your Ultra3000. This chapter includes these sections:

- General startup precautions
- Before you begin
- Configuring your Ultra3000 and Ultra3000 with indexing
- Configuring your Ultra3000 with SERCOS
- Configuring your Ultra3000 with DeviceNet

Note: Some of the procedures in this chapter include information regarding integration with other products.

General Startup Precautions

The following precautions pertain to all of the procedures in this chapter. Be sure to read and thoroughly understand them before proceeding.

ATTENTION

This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltages on the system bus network have been discharged before attempting to service, repair or remove this unit. Only qualified personnel familiar with solid state control equipment and safety procedures in publication NFPA 70E or applicable local codes should attempt this procedure.

ATTENTION

This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. You are required to follow static control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD Protection Handbook.

Before You Begin

These procedures assume you have completed mounting, wiring, and connecting your Ultra3000 drive as described in the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Use the table below to determine where to begin configuring your Ultra3000 drive.

If you are configuring this drive:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX	Go to <i>Configuring Your Ultra3000 and Ultra3000 with Indexing</i>
2098-DSD-xxx-SE or -HVxxx-SE	Go to <i>Configuring Your Ultra3000 with SERCOS interface</i>
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or -HVxxxX-DN	Go to <i>Configuring Your Ultra3000 with DeviceNet</i>

Configuring Your Ultra3000 and Ultra3000 with Indexing

The procedures in this section apply to Ultra3000 drives (2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX) and describe how to:

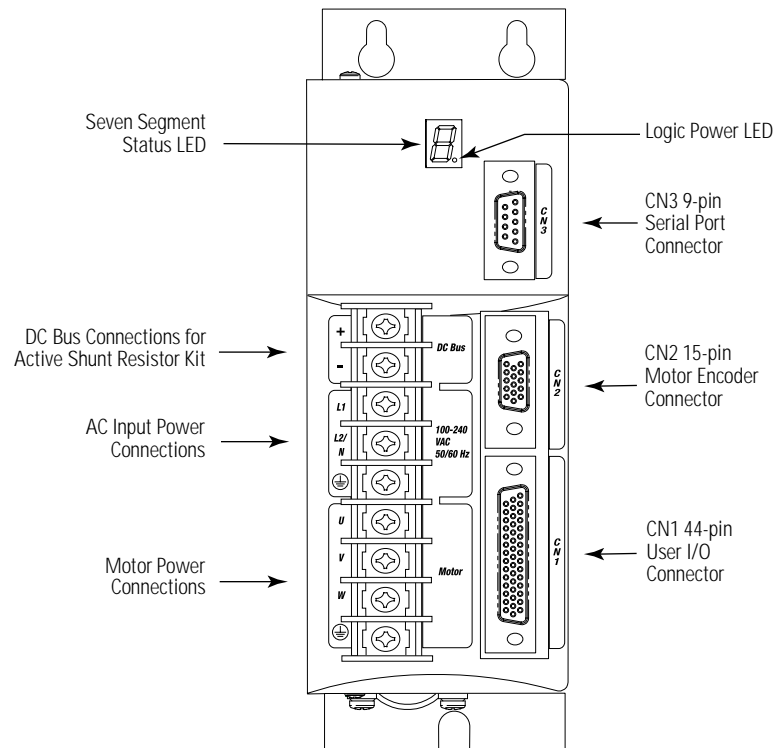
- Apply power to your Ultra3000 drive
- Detect your Ultra3000 drive
- Select a motor
- Tuning your motor
- Test your motor (non-indexing move)
- Test your motor (indexing move)
- Configure your Ultra3000 drive with the ControlLogix servo module

Front Panel Connections

This section provides front panel connection information for your Ultra3000 and Ultra3000 with indexing drive.

Use the figure below to locate the front panel connections on the Ultra3000 230V drives (500W, 1 kW, and 2 kW).

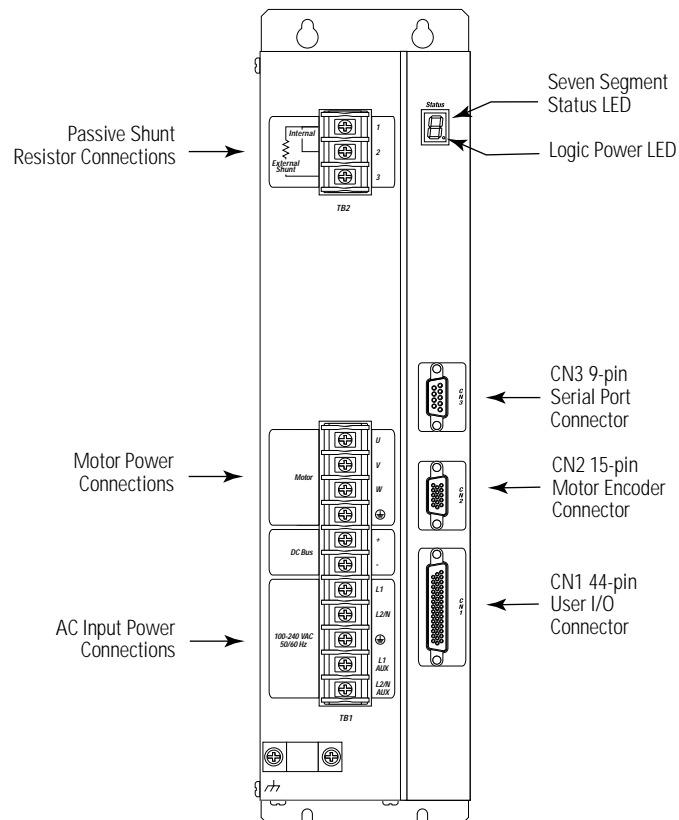
Figure 1.1
Ultra3000 Front Panel Connections
 for 2098-DSD-005, -005X, -010, -010X, -020, and -020X



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 230V drives (3 kW).

Figure 1.2
Ultra3000 Front Panel Connections for 2098-DSD-030 and -030X

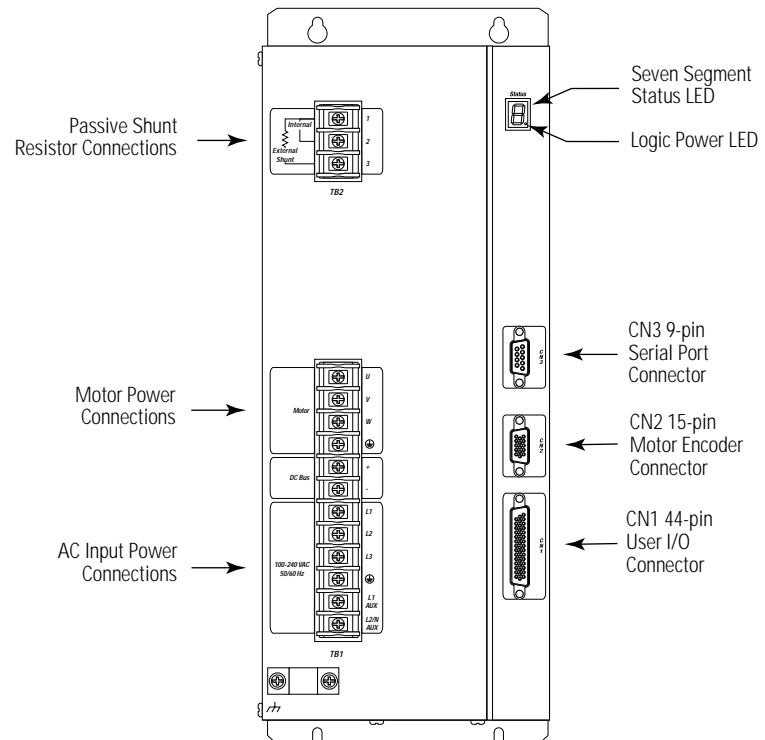


For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 230V (7.5 and 15 kW).

Figure 1.3

Ultra3000 Front Panel Connections for 2098-DSD-075, -075X, -150, and -150X

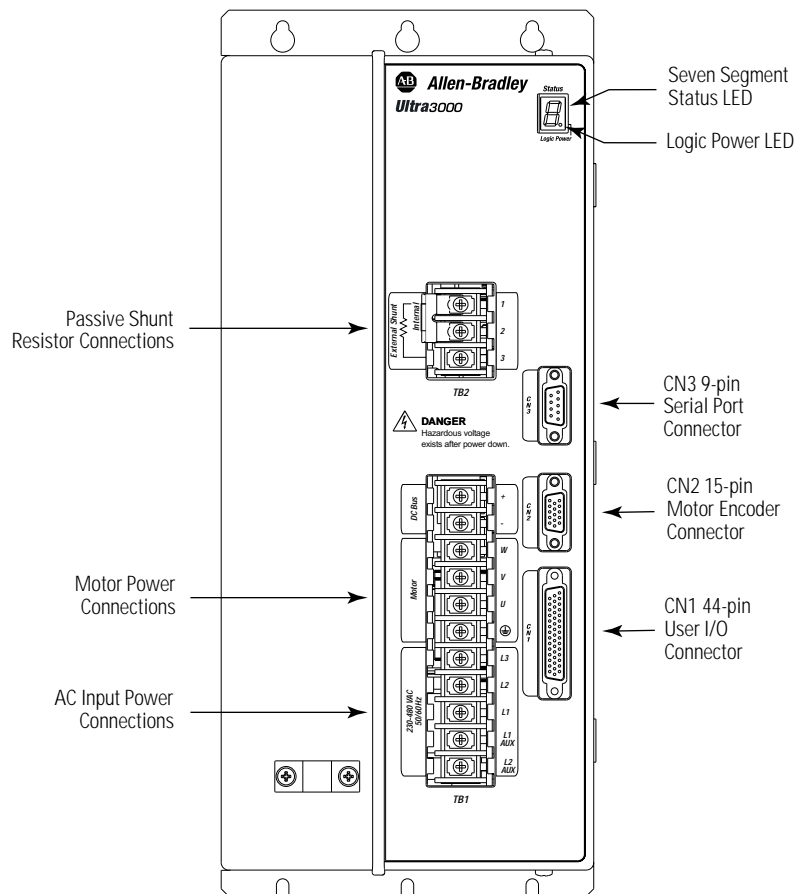


For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 460V drives (3W, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.4

Ultra3000 Front Panel Connections for 2098-DSD-HVxxx and HVxxxX



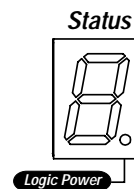
For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Applying Power To Your Ultra3000 Drive

This procedure assumes you have wired your Ultra3000 system, verified the wiring, and are ready to begin using your Ultraware software. To apply power to your Ultra3000 drive:

1. Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.
2. Apply input power to the Ultra3000 and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.5
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	<ol style="list-style-type: none"> 1. Check your input power connections. 2. Repeat main step 2.

3. Observe the front panel seven segment Status LED display as shown in Figure 1.5.

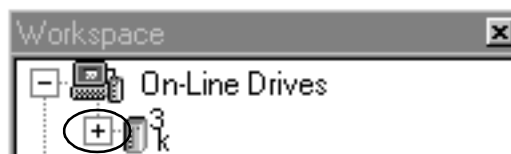
If the Status LED display on your:	Is:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX drive	Actively cycling segments in a full circle	The drive is ready. Go to <i>Detecting Your Ultra3000 Drive</i> on page 1-8.
	Flashing an "E" followed by two numbers	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

Detecting Your Ultra3000 Drive

This procedure assumes you have successfully applied power to your drive. By following these steps you will ensure that your Ultra3000 drive is communicating with your Ultraware software. To detect your Ultra3000 drive:

1. Start your Ultraware software. Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on starting the Ultraware software.
2. Create a new file. Ultraware will scan for on-line drives.
3. Click on the Stop Scanning button when your drive is detected or wait for the scanning to time out.
4. Look for the Ultra3000 icon (Ultra3k) under the On-Line Drives tree. The Ultra3000 icon indicates that your drive is detected.

Figure 1.6
Ultra3000 Icon



5. Click on the [+] next to the Ultra3k icon to expand the branch menu (as indicated in the window above).

6.

If your Ultra3000 drive:	Then:
Is detected and listed under the On-Line Drives tree	<ol style="list-style-type: none"> 1. The software and hardware are communicating and the system is ready. 2. Go to the section <i>Selecting a Motor</i>.
Is not detected	<ol style="list-style-type: none"> 1. Check your serial cable connections. 2. Use Recover Communications... (in Ultraware) to establish a connection. 3. Go to main step 1 of this section.

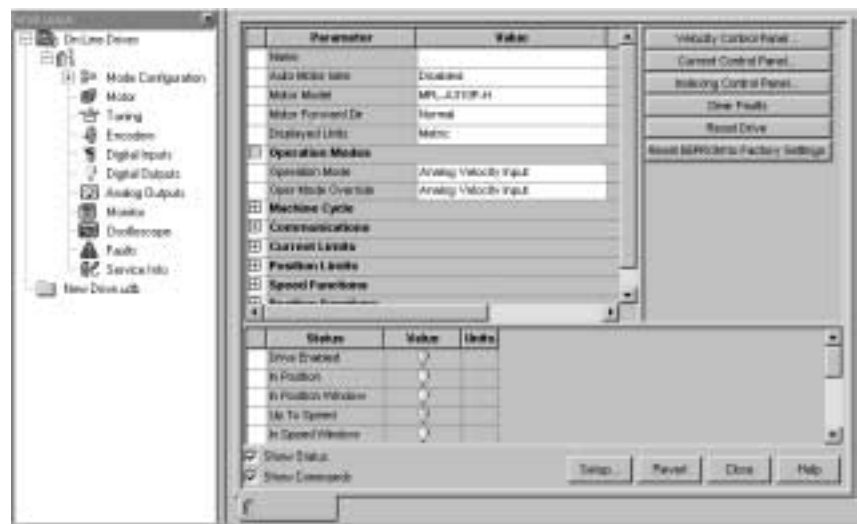
Selecting a Motor

This procedure assumes you have power applied to your drive and the drive is detected by the Ultraware software.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on selecting a motor.

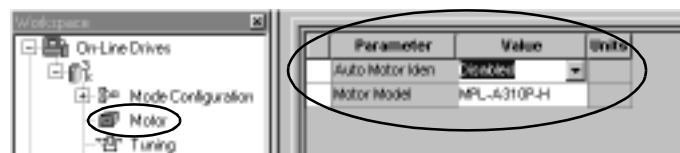
To select a motor:

1. Double click on the Ultra3000 icon (Ultra3k) under the On-Line Drives tree. The Ultra3000 Drive properties window opens.



Note: Actual values depend on your application.

2. Double click on the Motor branch. The motor branch property window opens.

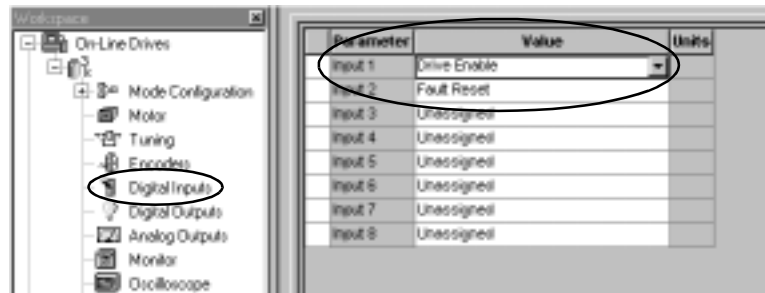


- 3.

If you have this motor:	Then:
An Allen-Bradley motor with an intelligent encoder	Leave Auto Motor Iden Enabled and go to step 6.
All others	Select Auto Motor Iden Disabled and go to main step 4.

4. In the box next to Motor Model, select the model number of your motor.

5. Close the Motor properties window.
6. Double-click on the Digital Inputs branch. The Digital Inputs properties window opens.



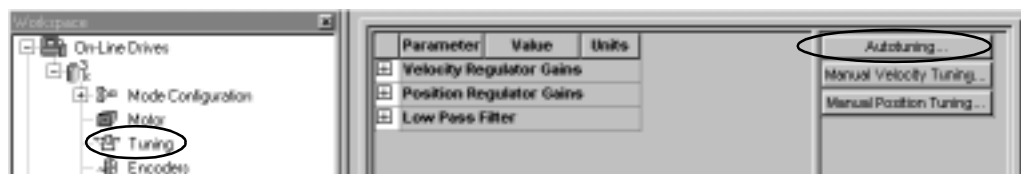
7. Set Input 1 value to **Drive Enable**.
8. Set Input 2 value to **Fault Reset**.
9. Close the Digital Inputs window.

Tuning Your Motor

This procedure assumes your drive is detected and you have selected a motor. In this procedure you will autotune your motor.

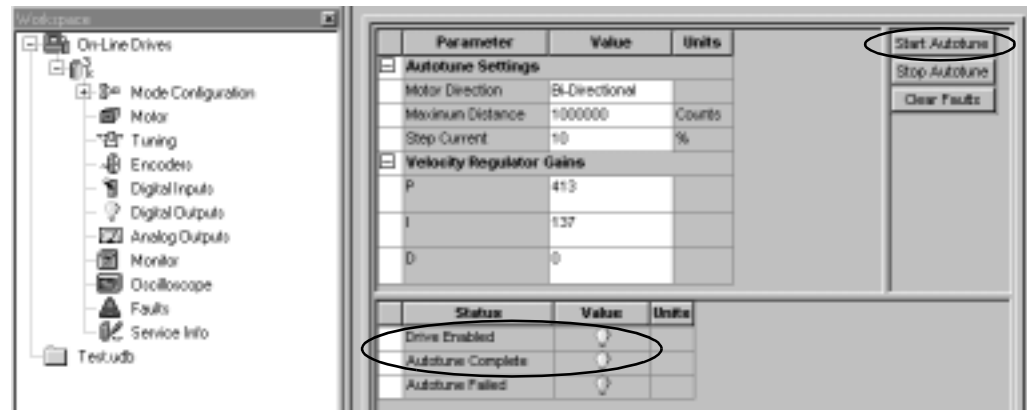
To autotune your motor:

1. Double-click on the Tuning branch. The Tuning branch properties window opens.



2. Select **Autotuning**. The Autotuning window opens.
3. Apply 12-24V to input 1. Input 1 was configured as Drive Enable in a previous step (Drive Enabled light turns yellow).
4. Select appropriate autotune settings for your application.

5. Select **Start Autotune**. The motor responds and the tuning process is complete (Autotune Complete light turns yellow).



Note: Actual values depend on your application.

6. Close the Tuning properties window.

Testing Your Motor (Non-Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have selected a motor. In this procedure you will enable the drive and set the motor velocity to test the motor.

Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on using the velocity control panel.

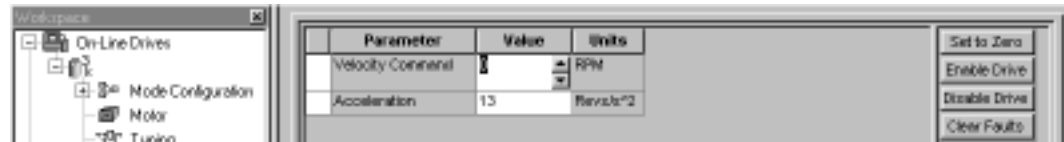
To test your motor:

1. Double-click the U3k icon. The drive properties window opens.

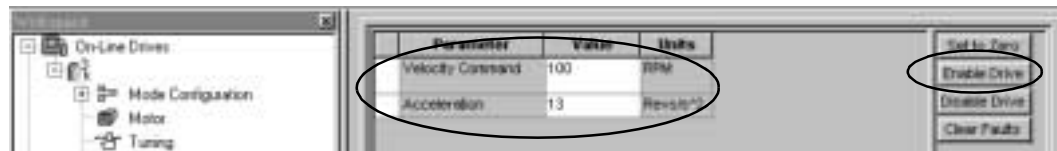


Note: Actual values depend on your application.

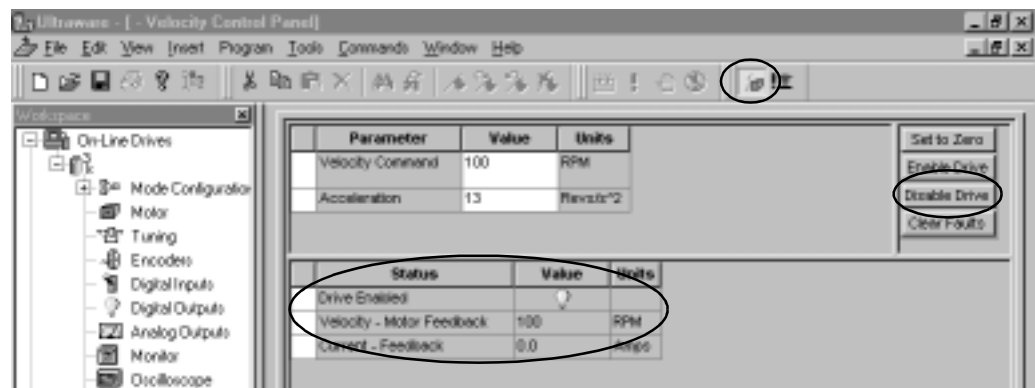
2. Select **Velocity Control Panel** (as indicated in the window above). The velocity control panel window opens.



3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Select **Enable Drive** (as indicated in the window below).



5. Enter an appropriate low speed in the velocity command value field.
6. Press **Enter**.
7. Observe the motor. The motor should be turning at the velocity you entered in step 5.
8. Observe the Status table (as indicated below).



- Drive Enable status = lamp is on (yellow)
- Velocity - Motor Feedback status = the value you entered in step 5.

9. Select **Disable Drive**. The motor stops.
10. Close the velocity control panel.
11. Select the **Enable** icon from the Ultraware toolbar.

Testing Your Motor (Indexing Move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have selected a motor. In this procedure you will enable the drive and make an incremental move to test the motor.

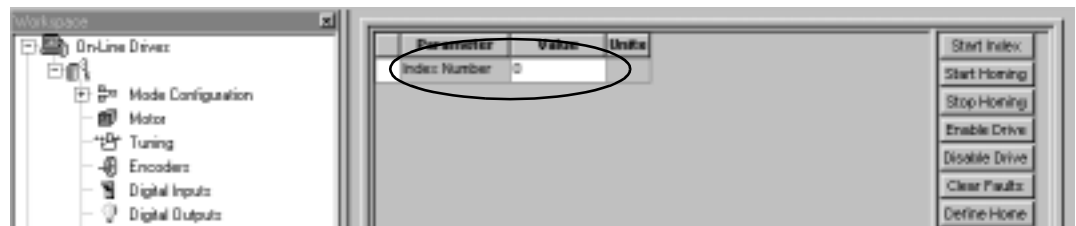
Note: Refer to the *Ultraware User Manual* (publication 2098-UM001x-EN-P) for more information on using the indexing control panel.

To test your motor:

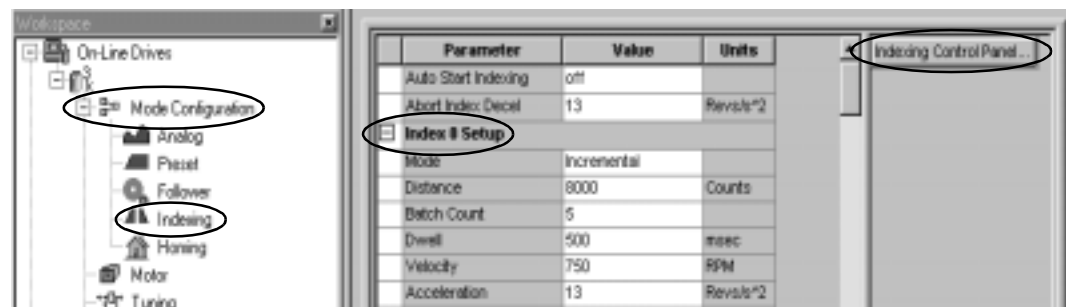
1. Double-click the U3k icon. The drive properties window opens.



2. Select **Indexing Control Panel** (as indicated in the window above). The indexing control panel window opens.



3. Apply 12-24V dc to input 1. Input 1 was configured as Drive Enable in a previous step.
4. Set the value of **Index Number** to 0.
5. Expand the **Mode Configuration** branch (as indicated in the window below) and double-click on Indexing. The Indexing Setup window opens.

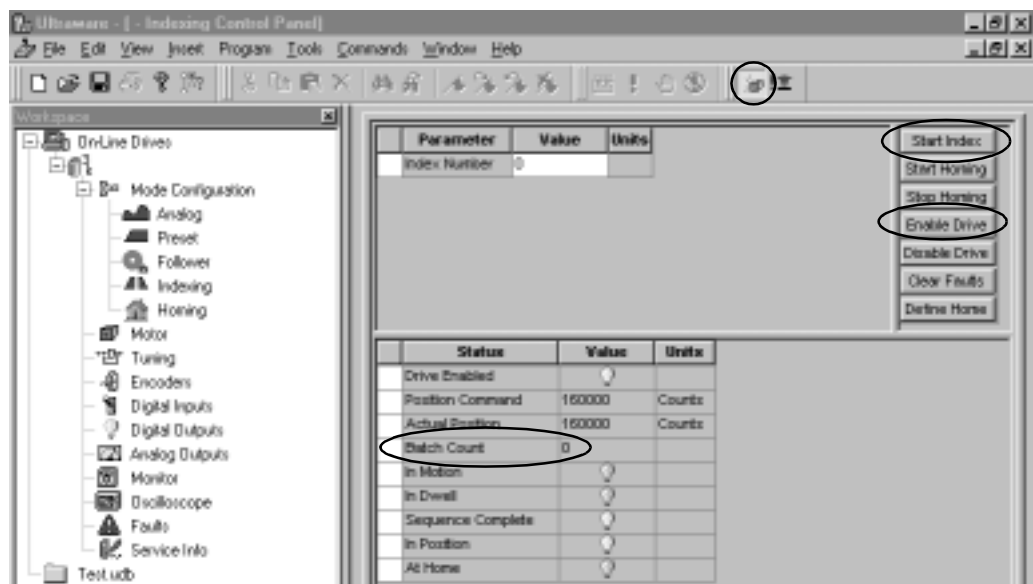


6. Expand **Index 0 Setup**. Configure your incremental move with the following values for Index 0:

- Mode = Incremental
- Distance = 8000 counts
- Batch count = 5
- Dwell = 500 ms
- Action When Complete = Stop
- Leave other defaulted parameters as is

Note: These settings may not be appropriate for your application.

7. Select **Indexing Control Panel**. The indexing control panel opens.



8. Select **Enable Drive**.

9. Select **Start Index**. Your incremental move begins.

10. Observe the Batch Count value count down from 5 to 0 while your move is running.

11. Close the indexing control panel window.

12. Close the indexing mode window.

13. Select the **Enable** icon from the Ultraware toolbar.

Configuring Your Ultra3000 Drive/ControlLogix Servo Module

In this section you will configure your Ultra3000 drive using Ultraware software, configure the 1756-M02AE Servo Module using RSLogix 5000,TM and test/tune your axis.

Note: For detailed configuration information, refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P).

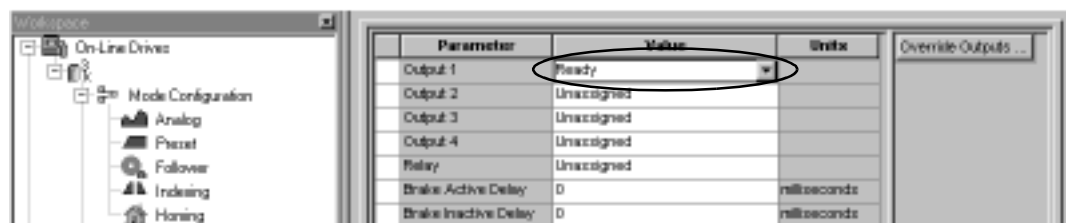
Configuring Your Ultra3000 Drive

To configure your Ultra3000 drive:

1. Apply power to your Ultra3000 drive (refer to the section *Applying Power To Your Ultra3000 Drive*).
2. Start your Ultraware software and ensure your Ultra3000 drive is detected (refer to the section *Detecting Your Ultra3000 Drive*).
3. Select a motor (refer to the section *Selecting a Motor*).
4. Expand **Operation Modes** in the Drive properties window.
5. Select **Analog Current Input** as the operation mode (as indicated in the window below).



6. Double-click on **Digital Outputs**. The Digital Output properties window opens.



7. Select **Ready** as the value of Output 1.

Configuring Your 1756-M02AE Servo Module

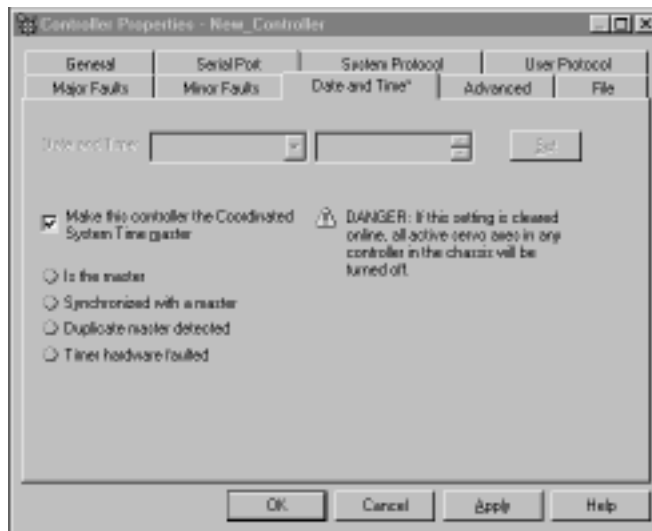
To configure your 1756-M02AE Servo Module and create a program including your Ultra3000 (non-SERCOS) drive:

1.

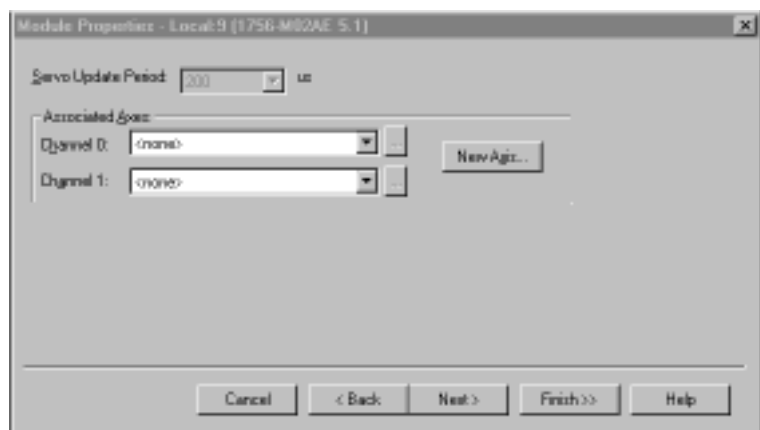
If you have:	Then:
Already configured your 1756-M02AE servo module using the <i>ControlLogix Motion Module Setup and Configuration Manual</i> (publication 1756-UM006x-EN-P)	Go to the section <i>Testing and Tuning Your Axis</i> .
Not configured your 1756-M02AE servo module	Go to step 2.

2. Apply power to your ControlLogix chassis containing the 1756-M02AE SERCOS interface module and open your RSLogix 5000 software. Refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P) for specific instructions and troubleshooting.
3. Select **New** in the File menu. The New Controller window opens.
 - Select controller type
 - Name the file
 - Select the ControlLogix chassis size
 - Select the ControlLogix processor slot
4. Select **OK**.
5. Select **Controller Properties** in the edit menu. The Controller Properties window opens.

6. Select the **Date and Time** tab. The following window opens.



7. Check the box **Make this controller the Coordinated System Time master**.
8. Select **OK**.
9. Right-click on I/O Configuration in the explorer window and select **New Module**. The Select Module Type window opens.
10. Select **1756-M02AE**.
11. Select **OK**. The Module Properties wizard opens.
- Name the module
 - Select the slot where your module resides
 - Select an Electronic Keying option.
12. Select **Next** until the following window opens.



13. Select the **New Axis** button. The New Tag window opens.

- Name the axis
- Select **AXIS_SERVO** as the Data Type

14. Select **OK**.

15. Assign your axis to a node address (as shown in the window below).



16. Select **Finish**.

17. Right-click Motion Groups in the explorer window and select **New Motion Group**. The New Tag window opens.

18. Name new motion group.

19. Select **OK**. New group appears under Motion Group folder.

20. Drag-and-drop axis from Ungrouped Axis folder to your new Motion Group folder.

21. Download your program to the ControlLogix processor.

Testing and Tuning Your Axis

This procedure assumes that you have configured your Ultra3000 and your 1756-M02AE servo module.

Note: For detailed testing and tuning information, refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P).

To test and tune your axis:

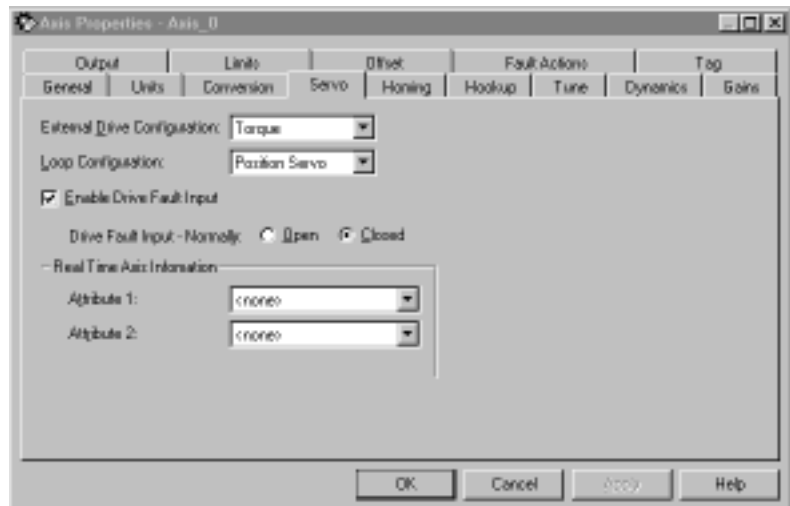
1.

If you have:	Then:
Already tested and tuned your 1756-M02AE servo module axis using the <i>ControlLogix Motion Module Setup and Configuration Manual</i> (publication 1756-UM006x-EN-P)	You are finished commissioning your Ultra3000.
Not tested and tuned your 1756-M02AE servo module axis	Go to step 2.

2. Remove load from your axis.

3. Right-click on the axis in your Motion Group folder in the explorer window and select **Axis Properties**. The Axis Properties window opens.

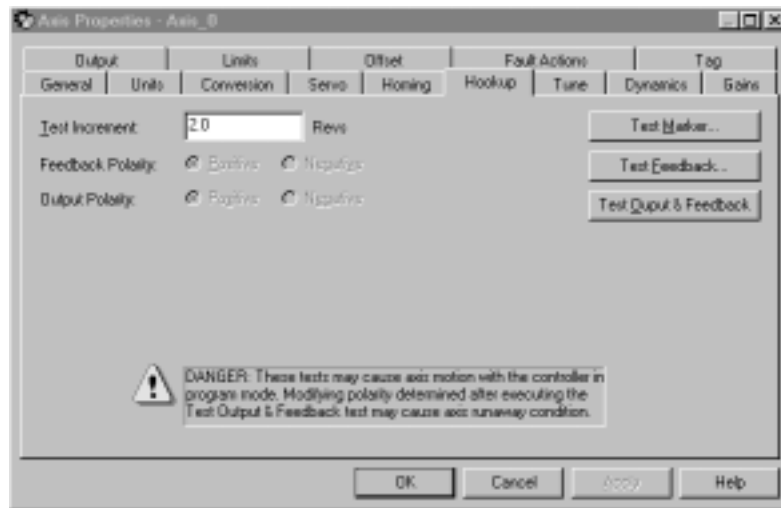
4. Select the **Servo** tab.



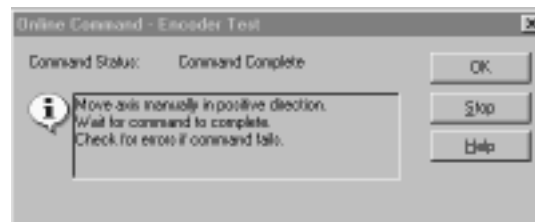
5. Select **Torque** as the External Drive Configuration.

6. Check the box **Enable Drive Fault Input** and select **Normally Closed**.

7. Select the **Hookup** tab.



8. Select **2.0** as the number of revolutions for the test (or another number more appropriate for your application).
9. Select the **Test Feedback** button to verify feedback connections. The Online Command - Encoder Test window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.

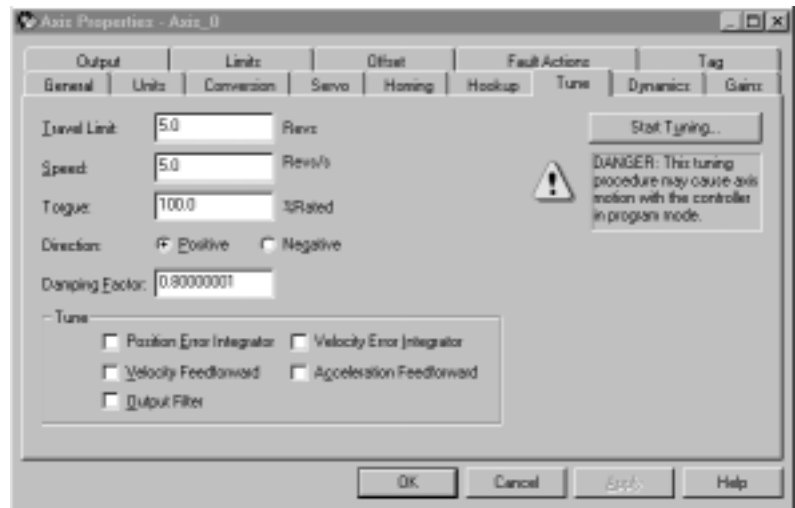


10. Select **OK**.
11. The Online Command - Apply Test window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



12. Select **OK**.

13. Select the **Tune** tab.



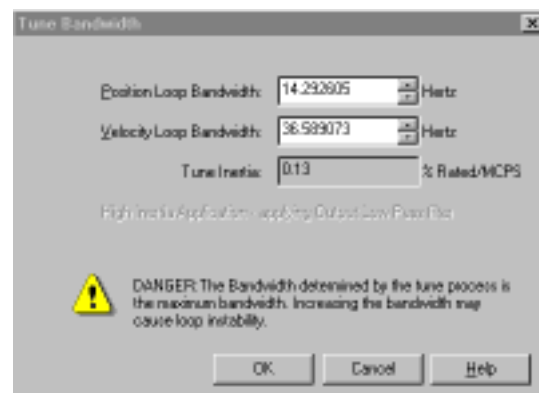
14. Enter values for Travel Limit and Speed. In this example both Travel Limit and Speed equal 5 revs(/s).

Note: Actual values (Revs) depend on your application.

15. Select the **Start Tuning** button to auto-tune your axis. The Online Command - Tune Servo window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



16. Select **OK**. The Tune Bandwidth window opens.



Note: Actual bandwidth values depend on your application.

17. Select **OK**.

18. The Online Command - Apply Tune window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



19. Select **OK**.

Configuring Your Ultra3000 with SERCOS interface

The procedures in this section apply to Ultra3000 drives (2098-DSD-xxx-SE and -HVxxx-SE) and describe how to:

- Configure your Ultra3000 drive
- Configure your 1756-M08SE SERCOS interface module using RSLogix 5000 software
- Download your program to your ControlLogix controller
- Apply power to your Ultra3000 drive
- Test and tune your motor using RSLogix 5000 software.

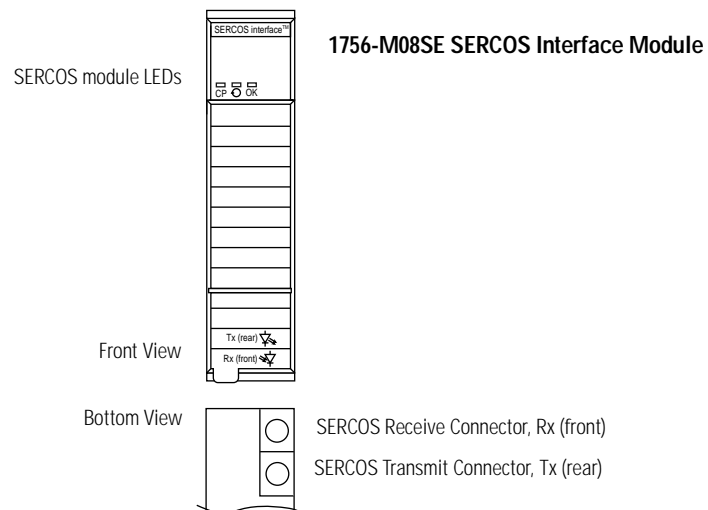
These procedures assume you have wired the fiber optic cables between your Ultra3000 drive and the 1756-M08SE SERCOS module.

Front Panel Connections

This section provides front panel connection information for your Ultra3000 with SERCOS interface and 1756-M08SE SERCOS module.

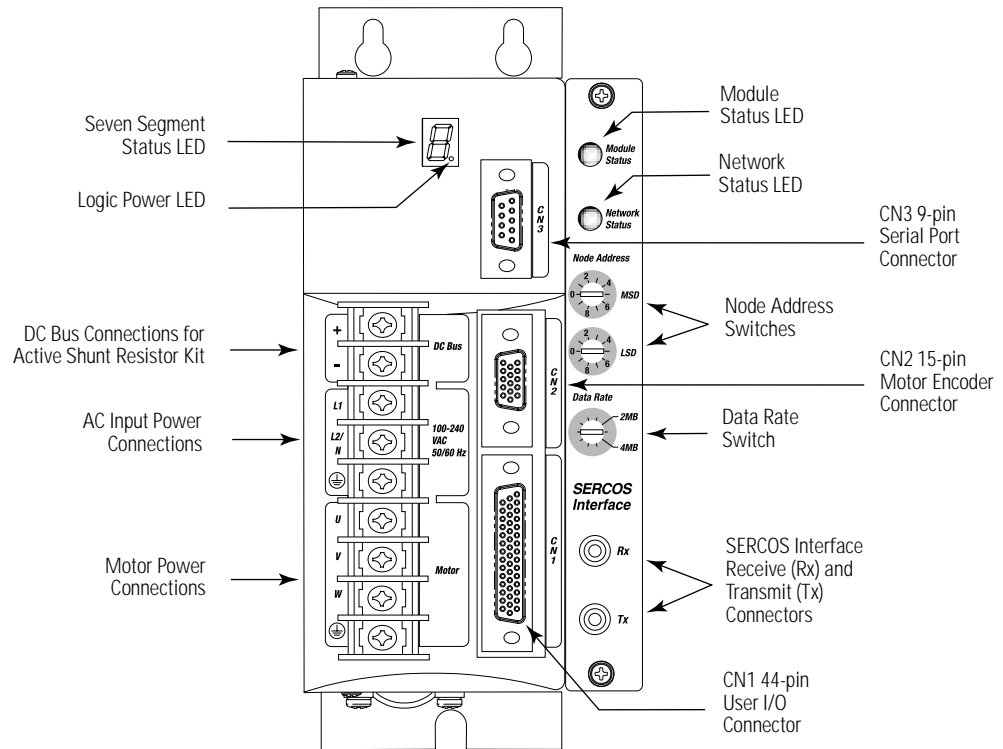
Use the figure below to locate the SERCOS ring LEDs and fiber optic cable connections on your 1756-M08SE SERCOS module.

Figure 1.7
1756-M08SE SERCOS Connector and LED Locations



Use the figure below to locate the front panel connections on the Ultra3000 with SERCOS interface 230V drives (500W, 1 kW, and 2 kW).

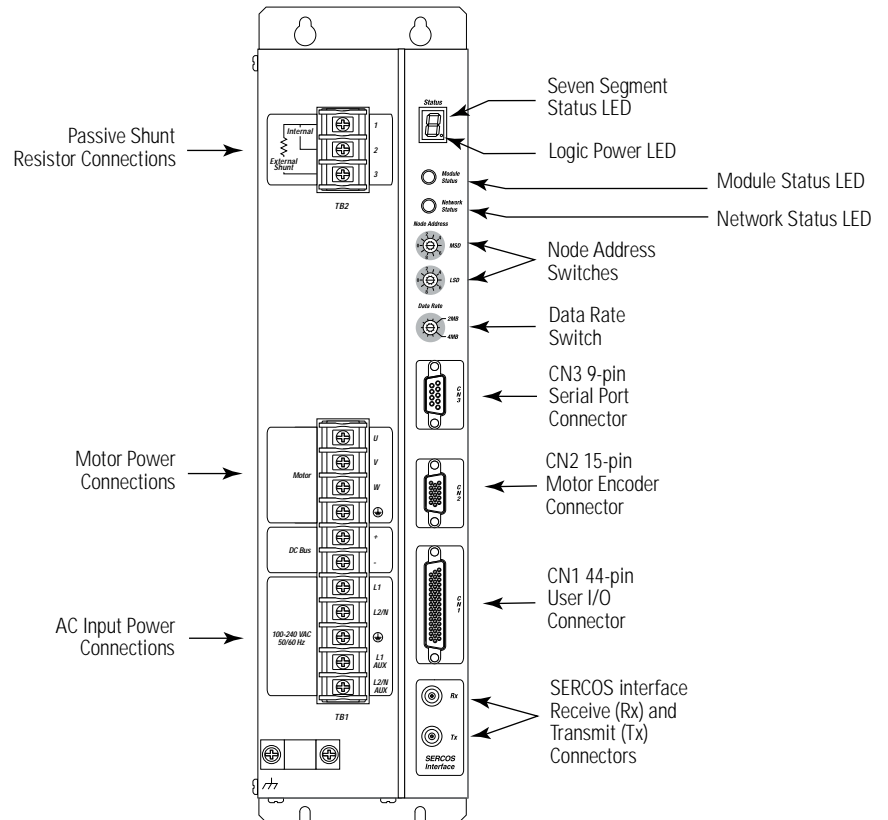
Figure 1.8
Ultra3000 Front Panel Connections for 2098-DSD-005-SE, -010-SE, and -020-SE



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with SERCOS interface 230V drive (3 kW).

Figure 1.9
Ultra3000 Front Panel Connections for 2098-DSD-030-SE

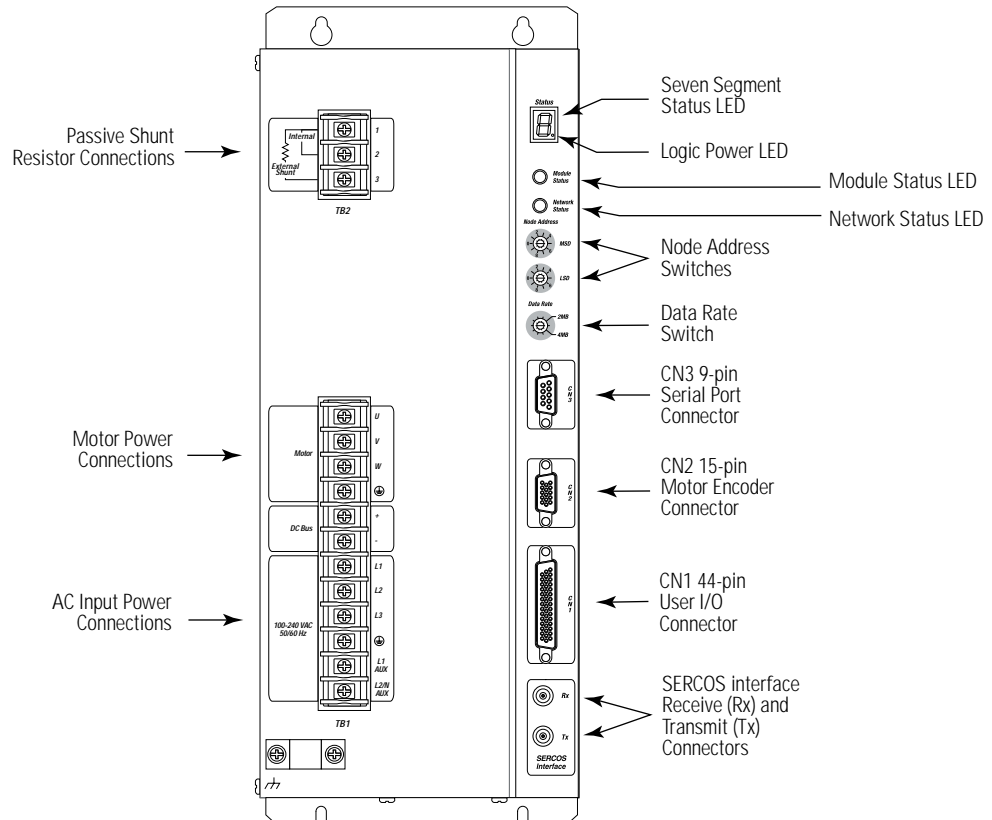


For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with SERCOS interface 230V drives (7.5 and 15 kW).

Figure 1.10

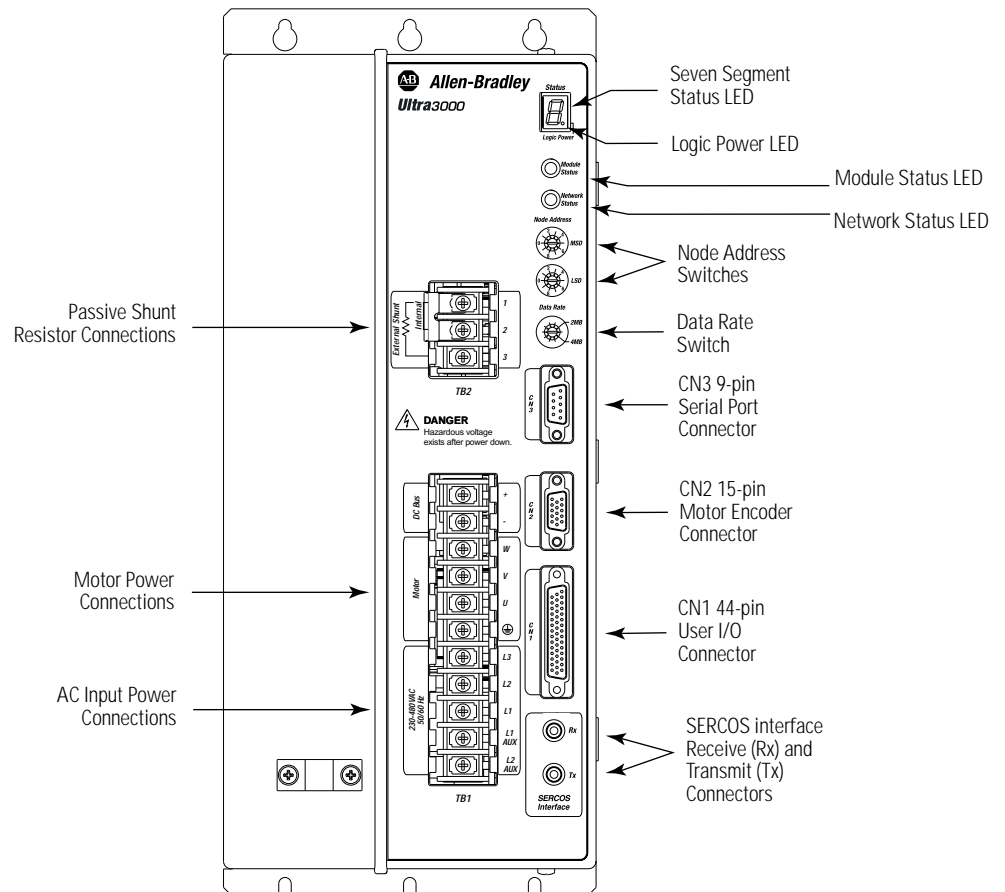
Ultra3000 Front Panel Connections for 2098-DSD-075-SE and -150-SE



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with SERCOS interface 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.11
Ultra3000 Front Panel Connections for 2098-DSD-HVxxx-SE



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Configuring Your Ultra3000 with SERCOS interface

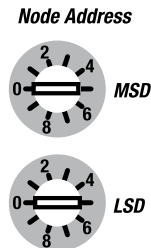
Use the following procedures to configure your Ultra3000 drive (2098-DSD-xxx-SE), configure your 1756-M08SE SERCOS interface module, apply power to the system, and test/tune your motor.

To configure your Ultra3000 drive:

1.
- Verify that there is no power applied to the drive, and the SERCOS fiber optic cables are correctly plugged into the Tx and Rx connectors. To verify your fiber optic cable connections, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003X-EN-P).
2.
- Set the node address for each drive in your system. Valid node addresses are 01-99. The MSD rotary switch sets the most significant digit and the LSD rotary switch sets the least significant digit. Refer to figures 1.8-1.10 for the location of the switches. Refer to the table below for examples.

For this Node Address:	Set the MSD switch to:	Set the LSD switch to:
10	1	0
11	1	1
12	1	2

Use the MSD and LSD rotary switches on the SERCOS panel of the drive to set node addresses. Refer to Figure 1.12 for node address setting examples.



3.
- Set the data rate. Valid data rates are 2M baud and 4M baud. Refer to figures 1.8-1.10 for the location of the switch.

Use the Data Rate rotary switch on the SERCOS panel of the drive to set the data rate.

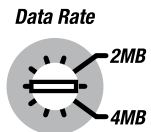
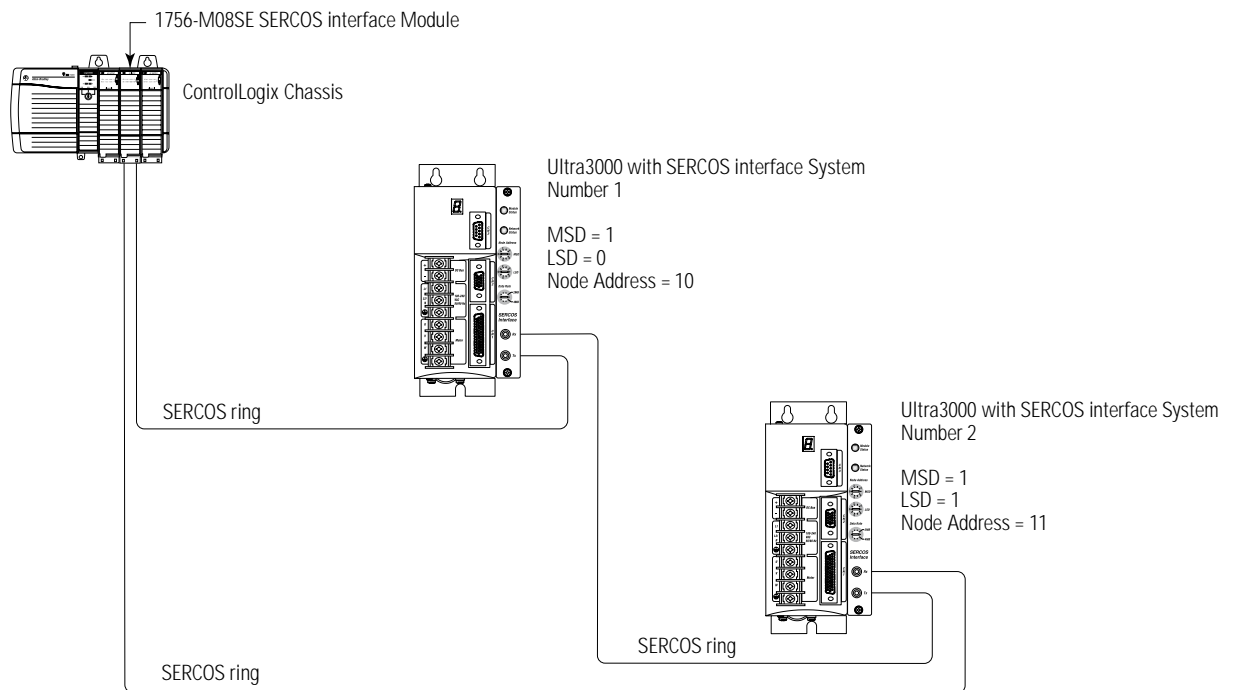


Figure 1.12
Ultra3000 Node Addresses



4. Verify CN1-31 (Input 1) is configured as Drive Enable and tied to 12-24V dc.
5. If using Overtravel inputs, verify that 12-24V dc is tied to CN1-37 and -38.

IMPORTANT

Without CN1-37 and -38 inputs applied, the drive/system will fault.

Configuring Your 1756-M08SE SERCOS interface Module

This procedure assumes that you have finished configuring your Ultra3000 drive.

Note: For detailed configuration information, refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P).

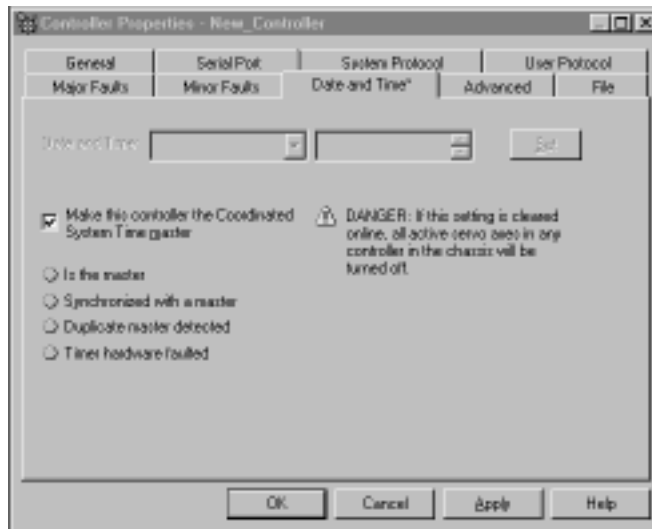
To configure your 1756-M08SE SERCOS interface module and create a program including your 2098-DSD-xxx-SE drive:

1.

If you have:	Then:
Already configured your 1756-M08SE SERCOS interface module using the <i>ControlLogix Motion Module Setup and Configuration Manual</i> (publication 1756-UM006x-EN-P)	Go to section <i>Applying Power To Your Ultra3000 with SERCOS</i> .
Not configured your 1756-M08SE SERCOS interface module	Go to step 2.

2. Apply power to your ControlLogix chassis containing the 1756-M08SE SERCOS interface module and open your RSLogix 5000 software. Refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P) for specific configuration instructions and troubleshooting.
3. Select **New** in the File menu. The New Controller window opens.
 - Select controller type
 - Name the file
 - Select the ControlLogix chassis size
 - Select the ControlLogix processor slot
4. Select **OK**.
5. Select **Controller Properties** in the edit menu. The Controller Properties window opens.

6. Select the **Date and Time** tab. The following window opens.



7. Check the box **Make this controller the Coordinated System Time master**.
8. Select **OK**.
9. Right-click on I/O Configuration in the explorer window and select **New Module**. The Select Module Type window opens.
10. Select **1756-M08SE**.
11. Select **OK**. The Module Properties wizard opens.
- Name the module
 - Select the slot where your module resides
 - Select an Electronic Keying option.
12. Select **Next** until the following window opens.



13. Select **Cycle Time** and **Transmit Power** settings.

- Set the Cycle Time to 1.0 ms for 1-4 axes and 2.0 ms for 5-8 axes.
- Set the Transmit Power setting to High.

14. Select **Finish**. Your new 1756-M08SE servo module appears under the I/O Configuration folder in the explorer window.**15.** Right-click on your new module and select **New Module**. The Select Module Type window opens.**16.** Select your 2098-DSD-xxx-SE drive.**17.** Select **OK**. The Module Properties window opens.

- Name the module
- Set the Node

Note: Set node in the software to match the node setting on the drive. Refer to *Configuring Your Ultra3000 with SERCOS interface*, step 2, on page 1-28.

- Select an Electronic Keying option

18. Select **Next** until the following window appears.**19.** Select the **New Axis** button. The New Tag window opens.

- Name the axis
- Select **AXIS_SERVO_DRIVE** as the Data Type

20. Select **OK**.

- 21.** Assign your axis to a node address (as shown in the window below).



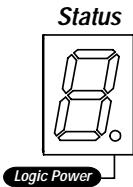
- 22.** Select **Next. Bus Regulator Catalog Number** (shunt option) does not apply. Select **<none>**.
- 23.** Select **Finish**.
- 24.** Right-click Motion Groups in the explorer window and select **New Motion Group**. The New Tag window opens.
- 25.** Name new motion group.
- 26.** Select **OK**. New group appears under Motion Group folder.
- 27.** Drag-and-drop axis from Ungrouped Axis folder to your new Motion Group folder.
- 28.** Double-click on your axis to open the Axis Properties window.
- 29.** Select **Drive** tab and set Amplifier Catalog Number.
- 30.** Select **Motor/Feedback** tab and set Motor Catalog Number.
- 31.** Select **OK**.
- 32.** Download your program to the ControlLogix processor.

Applying Power To Your Ultra3000 with SERCOS

This procedure assumes you have configured your Ultra3000 drive and your 1756-M08SE SERCOS module. To apply power to your Ultra3000 drive:

1.
- Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.
2.
- Apply input power to the Ultra3000 and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.13
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	1. Check your input power connections. 2. Repeat main step 2.

3.
- Observe the front panel seven segment Status LED display as shown in Figure 1.13.

If the Status LED display on your:	Is:	Then:
2098-DSD-xxx-SE or -HVxxx-SE drive	Displaying a fixed 0, 1, 2, 3, or 4	The drive is ready. Go to main step 4.
	Flashing an “E” followed by two numbers	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

4.
- Observe the module status LED.

If the module status LED:	Then:
Is steady green	The drive is enabled. Go to step 5.
Flashes green	The drive is disabled. Go to step 5.
Is not steady or flashing green	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

5. Observe the network status LED.

If the network status LED:	Then:
Flashes green	Establishing communication with network (wait for steady green).
Illuminates steady green	Communication is ready. Go to step 6.
Is not flashing or steady green	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

6. Observe the three SERCOS LEDs on the 1756-M08SE module.

If the three SERCOS LEDs:	Then:
Flash green and red	Establishing communication (wait for steady green on all three LEDs).
Illuminates steady green	Communication ready. Go to <i>Testing and Tuning Your Axes</i> .
Is not flashing or steady green	Go to the <i>ControlLogix Motion Module Setup and Configuration Manual</i> (publication 1756-UM006x-EN-P) for specific instructions and troubleshooting.

Testing and Tuning Your Axes

This procedure assumes that you have configured your Ultra3000 and your 1756-M08SE SERCOS interface module.

Note: For detailed testing and tuning information, refer to the *ControlLogix Motion Module Setup and Configuration Manual* (publication 1756-UM006x-EN-P).

To test and tune each axis:

1.

If you have:	Then:
Already tested and tuned your 1756-M08SE SERCOS interface module axes using the <i>ControlLogix Motion Module Setup and Configuration Manual</i> (publication 1756-UM006x-EN-P)	You are finished commissioning your Ultra3000.
Not tested and tuned your 1756-M08SE SERCOS interface module axes	Go to step 2.

2. Remove load from your axis.

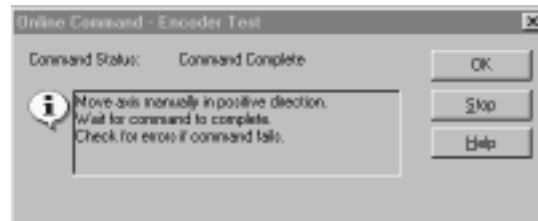
3. Right-click on the axis in your Motion Group folder in the explorer window and select **Axis Properties**. The Axis Properties window opens.

4. Select the **Hookup** tab.



5. Select **2.0** as the number of revolutions for the test (or another number more appropriate for your application).

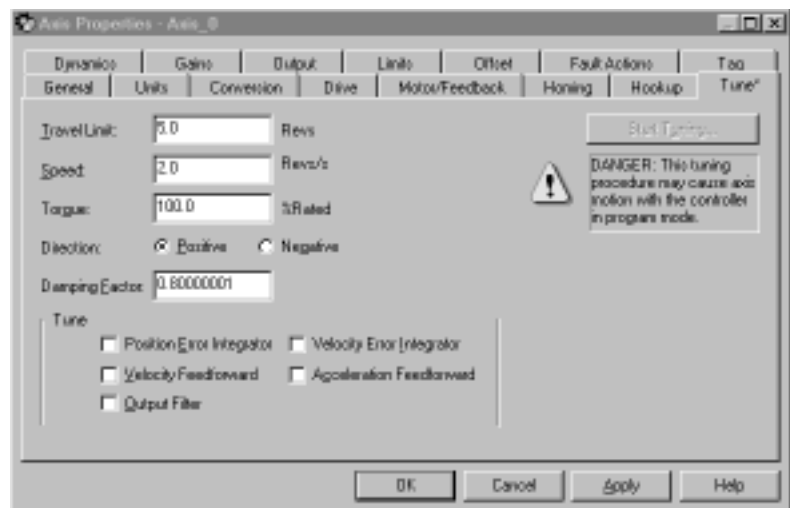
6. Select the **Test Feedback** button to verify feedback connections. The Online Command - Encoder Test window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



7. Select **OK**.
8. The Online Command - Apply Test window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



9. Select **OK**.
10. Select the **Tune** tab.



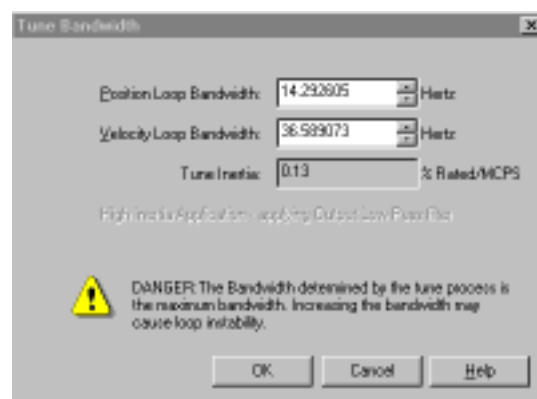
11. Enter values for Travel Limit and Speed. In this example, Travel Limit = 5 and Speed = 2.

Note: Actual values depend on your application.

- 12.** Select the **Start Tuning** button to auto-tune your axis. The Online Command - Tune Servo window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



- 13.** Select **OK**. The Tune Bandwidth window opens.



Note: Actual values depend on your application.

- 14.** Select **OK**.
- 15.** The Online Command - Apply Tune window opens. When the test completes, the Command Status changes from *Executing* to *Command Complete*.



- 16.** Select **OK**.

Configuring Your Ultra3000 with DeviceNet

The procedures in this section apply to Ultra3000 drives (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, and -HVxxxX-DN) and describe how to:

- Configure your Ultra3000 drive
- Apply power to your Ultra3000 drive

These procedures assume you have completed wiring the DeviceNet interface connector on your Ultra3000 drive.

Front Panel Connections

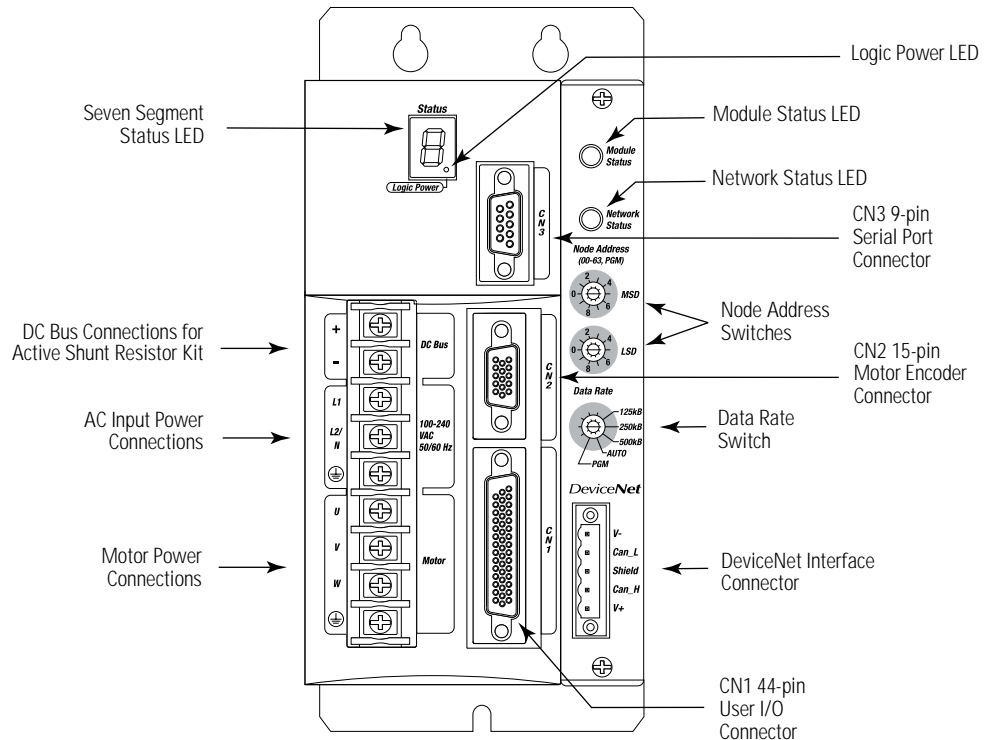
This section provides front panel connection information for your Ultra3000 with DeviceNet.

Use the figure below to locate the front panel connections on the Ultra3000 with DeviceNet Interface 230V drives (500W, 1 kW, and 2 kW).

Figure 1.14

Ultra3000 Front Panel Connections

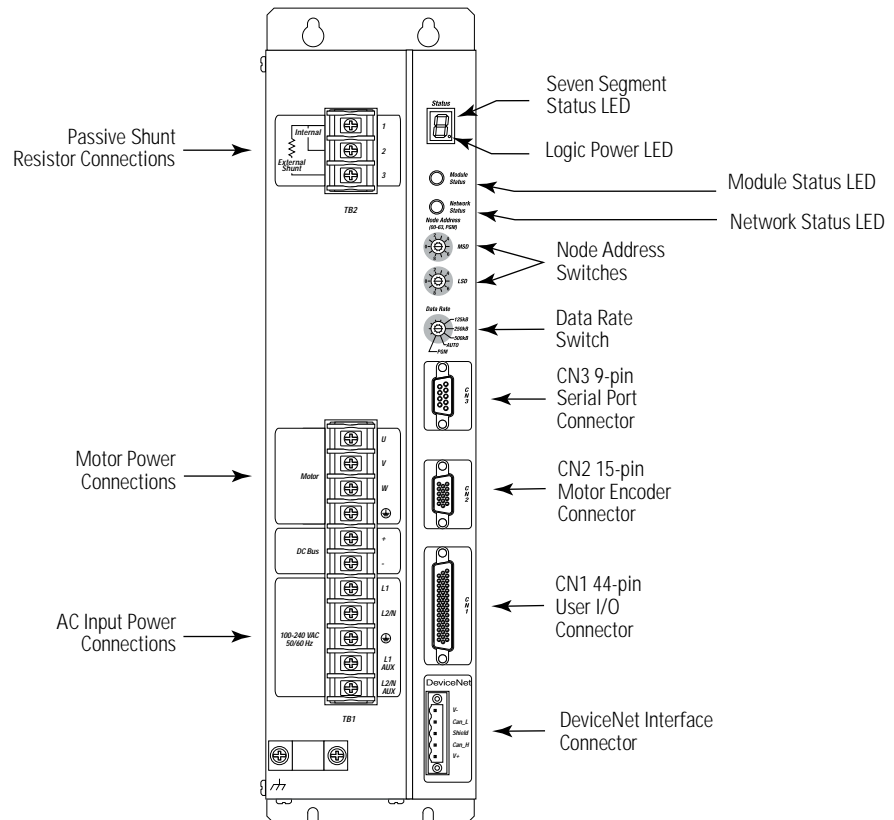
for 2098-DSD-005-DN, -005X-DN, -010-DN, -010X-DN, -020-DN, and -020X-DN



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with DeviceNet Interface 230V drives (3 kW).

Figure 1.15
Ultra3000 Front Panel Connections for 2098-DSD-030-DN and -030X-DN



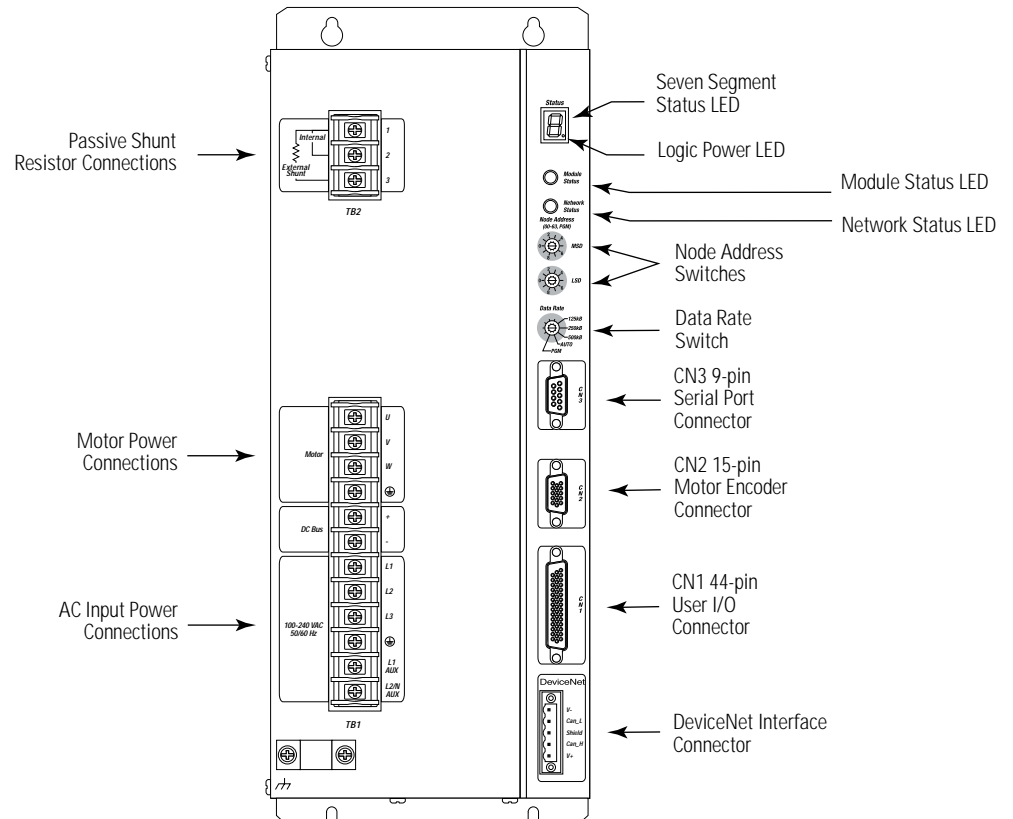
For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with DeviceNet Interface 230V drives (7.5 and 15 kW).

Figure 1.16

Ultra3000 Front Panel Connections

for 2098-DSD-075-DN, -075X-DN, -150-DN, and -150X-DN

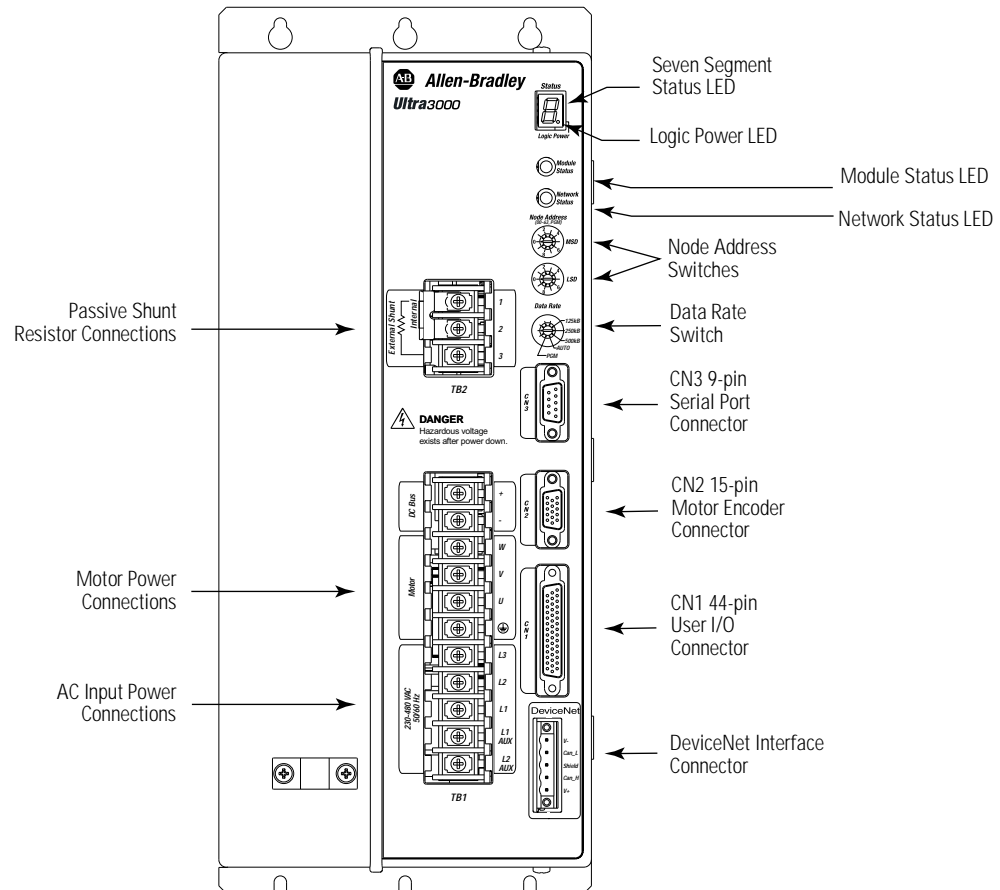


For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Use the figure below to locate the front panel connections on the Ultra3000 with DeviceNet Interface 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 1.17

Ultra3000 Front Panel Connections for 2098-DSD-HVxxx-DN and HVxxxX-DN



For CN1, CN2, and CN3 connector pin-out information, refer to *Ultra3000 Connector Pin-outs* in *Appendix A*.

Configuring Your Ultra3000 with DeviceNet

Use the following procedures to configure your Ultra3000 drive (2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, and -HVxxxX-DN) using Ultraware software and apply power to the drive.

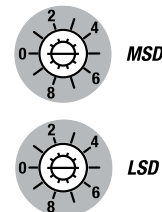
To configure your Ultra3000 drive with DeviceNet:

1. Verify that there is no power applied to the drive, and the DeviceNet cable is connected (refer to figures 1.14-1.16 for the connector location).
2. Set the node address for each drive in your system. Valid node addresses are 00-63 and PGM. The MSD rotary switch sets the most significant digit and the LSD rotary switch sets the least significant digit. Refer to figures 1.14-1.16 for the switch locations. Refer to the table below for examples.

For this Node Address:	Set the MSD switch to:	Set the LSD switch to:
10	1	0
11	1	1
12	1	2

Use the MSD and LSD rotary switches on the DeviceNet panel of the drive to set node addresses.

Node Address
(00-63, PGM)



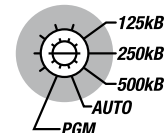
Note: Selecting an invalid node address (> 63) sets the node address according to a non-volatile parameter stored in the drive.

3. Set the data rate. Valid data rates are 125 kps, 250 kps, 500 kps, AUTO, and PGM. Refer to figures 1.14-1.16 for the switch location.

Note: Selecting AUTO automatically matches the device data rate to the rate of the network. Selecting PGM sets the data rate according to a non-volatile parameter stored in the drive.

Use the Data Rate rotary switch on the DeviceNet panel of the drive to set the data rate.

Data Rate

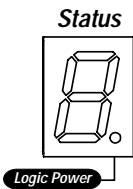


Applying Power To Your Ultra3000 with DeviceNet

This procedure assumes you have wired your Ultra3000 system, verified the wiring, and are ready to begin using your Ultraware software. To apply power to your Ultra3000 drive:

- 1. Disconnect any load to the motor. Ensure the motor is free of all linkages when initially applying power to the system.
- 2. Apply input power to the Ultra3000 and observe the front panel Logic Power indicator LED as shown in the figure below.

Figure 1.18
Logic Power and Status LED Display



If the Logic Power LED is:	Then:
ON	Go to main step 3.
Not ON	1. Check your input power connections. 2. Repeat main step 2.

- 3. Observe the front panel seven segment Status LED display as shown in Figure 1.18.

If the Status LED display on your:	Is:	Then:
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, or HV-xxxX-DN drive	Actively cycling segments in a full circle	The drive is ready. Go to step 4.
	Flashing an "E" followed by two numbers	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

- 4. Observe the module status LED.

If the module status LED:	Then:
Is steady green	The drive is ready. Go to step 5.
Is not steady green	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

5. Observe the network status LED.

If the network status LED:	Then:
Is off	Establishing communication with network (wait for flashing or steady green).
Is flashing or steady green	Communication is ready. Go to step 6.
Is not flashing or steady green	Go to the chapter <i>Troubleshooting Your Ultra3000</i> .

6. For further commissioning procedures, refer to the following sections beginning on page 1-8.

- *Detecting Your Ultra3000 Drive*
- *Selecting a Motor*
- *Tuning Your Motor*
- *Testing Your Motor (Non-Indexing Move)*
- *Testing Your Motor (Indexing Move)*
- *Configuring Your Ultra3000 Drive/ControlLogix Servo Module*

Refer to the *Ultra3000 with DeviceNet Reference Manual* (publication 2098-RM001x-EN-P) for information on communicating to the Ultra3000 using DeviceNet.

Troubleshooting Your Ultra3000

Chapter Objectives

This chapter provides a description of maintenance and troubleshooting activities for the Ultra3000. This chapter includes these sections:

- Maintaining the drive
- General troubleshooting
- Troubleshooting for SERCOS drives
- Troubleshooting for DeviceNet drives

Maintaining the Drive

The Ultra3000 Drive is designed to function with a minimum of maintenance.

ATTENTION

DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds.

Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive.

Failure to observe this precaution could result in severe bodily injury or loss of life.

Periodic Maintenance

Normally the only maintenance required is removal of superficial dust and dirt from the drive and a quick check of cable insulation and connections.

Cleaning the Drive

To clean the drive, use an OSHA approved nozzle that provides compressed air under low pressure, less than 20 kPa (30 psi), to blow the exterior surface and the vents clean.

Inspecting the Cables

Ensure input power is disconnected before touching cables or connections and perform the following:

- Visually inspect all cables for abrasion.
- D-shell connectors should be inspected for proper seating and signal continuity end-to-end.

General Troubleshooting

Refer to the *Error Codes* section below to identify problems, potential causes, and appropriate actions to resolve the problems. If problems persist after attempting to troubleshoot the system, please contact your Allen-Bradley representative for further assistance. To determine if your Ultra3000 drive has an error, refer to the table below.

If the Logic Power LED is ON and the Status LED display on your:	Is:	Then:
2098-DSD-xxx, -xxxX, -HVxxx, or -HVxxxX drive	Actively cycling segments in a full circle	Your Ultra3000 drive is ready.
2098-DSD-xxx-DN, -xxxX-DN, -HVxxx-DN, -HVxxxX-DN drive		Your Ultra3000 drive is ready.
2098-DSD-xxx-SE or -HVxxx-SE drive	Displaying a fixed 0, 1, 2, 3, or 4	Your Ultra3000 drive is ready.
All drives	Flashing "E" followed by two numbers	Your Ultra3000 drive has an error. Proceed to the section <i>Error Codes</i> below.

Error Codes

The following list of problematic symptoms (no error code shown) and problems with assigned error codes is designed to help you resolve problems.

When a fault is detected, the 7-segment LED will display an E followed by the flashing of the two-digit error code, one digit at a time. This is repeated until the problem is cleared.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
	Power (PWR) indicator not ON	No AC power or auxiliary logic power.	Verify power AC power or auxiliary +5V logic power is applied to the Ultra3000.
		Internal power supply malfunction.	Call your Allen-Bradley representative.
	Motor jumps when first enabled	Motor wiring error.	Check motor wiring.
		Incorrect motor chosen.	Verify the proper motor is selected.
	Digital I/O not working correctly	I/O power supply disconnected.	Verify connections and I/O power source.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
01	Non-Volatile Memory Endurance Exceeded	Range of motion and number of home position definitions during the product life exceeds the maximum allowed (applies only to systems with absolute feedback).	This is an unrecoverable fault, the drive must be sent back to the factory.
02	Velocity Exceeds Position Rollover /2	The velocity command or feedback exceeds half the machine cycle length per millisecond (applies only when the machine cycle position rollover is enabled).	Increase machine cycle size or reduce velocity profile. This error only applies to firmware versions prior to 1.10.
03	Absolute Feedback Range Exceeded	The motor position exceeds +/- 2047 revolutions from the home position (applies only to systems with absolute feedback).	<ul style="list-style-type: none"> Decrease application range of motion. Upgrade firmware.
04	Motor Overtemperature	Motor thermostat trips due to: <ul style="list-style-type: none"> High motor ambient temperature and/or Excessive current 	<ul style="list-style-type: none"> Operate within (not above) the continuous torque rating for the ambient temperature (40°C maximum). Lower ambient temperature, increase motor cooling.
		Motor wiring error.	Check motor wiring.
		Incorrect motor selection.	Verify the proper motor has been selected.
05	IPM Fault	Motor cables shorted.	Verify continuity of motor power cable and connector.
		Motor winding shorted internally.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
		Ultra3000 temperature too high.	<ul style="list-style-type: none"> Check for clogged vents or defective fan. Ensure cooling is not restricted by insufficient space around the unit.
		Operation above continuous power rating.	<ul style="list-style-type: none"> Verify ambient temperature is not too high. Operate within the continuous power rating. Reduce acceleration rates.
		Ultra3000 has a bad IPM output, short circuit, or overcurrent.	Remove all power and motor connections, and perform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
06	Hardware Overtravel (SERCOS only)	Dedicated overtravel input is inactive.	<ul style="list-style-type: none"> Check wiring. Verify motion profile.
07	Channel BM Line Loss	Motor wiring error.	Check motor encoder wiring.
08	Channel AM Line Loss		
09	Bus Undervoltage	Low AC line/AC power input.	<ul style="list-style-type: none"> Verify voltage level of the incoming AC power. Check AC power source for glitches or line drop. Install an uninterruptible power supply (UPS) on your AC input.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
10	Bus Overvoltage	Excessive regeneration of power. When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the Ultra3000's power supply. The system faults to save itself from an overload.	<ul style="list-style-type: none"> Change the deceleration or motion profile. Use a larger system (motor and Ultra3000). Use a resistive shunt.
		Excessive AC input voltage.	Verify input is below within specifications.
		Output short circuit.	Remove all power and motor connections, and preform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
		Motor cabling wires shorted together.	Disconnect motor power cables from the drive. If faults stop, replace cable.
		Internal motor winding short circuit.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
11	Illegal Hall State	Incorrect phasing.	Check the Hall phasing.
		Bad connections.	<ul style="list-style-type: none"> Verify the Hall wiring. Verify 5V power supply to the encoder.
12	Home Search Failed	Home sensor and/or marker is outside the over travel limits.	<ul style="list-style-type: none"> Check wiring. Reposition the overtravel limits or sensor.
13	Home Position In Limit	Home sensor, marker, or final home position exceeds a hardware overtravel limit	<ul style="list-style-type: none"> Reposition the overtravel limits or home sensor. Adjust the final home position.
16	Software Overtravel (SERCOS only)	Programmed overtravel limit has been exceeded.	<ul style="list-style-type: none"> Verify motion profile. Verify overtravel settings are appropriate.
17	User-Specified Current Fault	User-Specified average current level has been exceeded.	Increase to a less restrictive setting.
18	Overspeed Fault	Motor speed has exceeded 125% of maximum rated speed.	<ul style="list-style-type: none"> Check cables for noise. Check tuning.
19	Excess Position Error	Position error limit was exceeded.	<ul style="list-style-type: none"> Increase the feed forward gain. Increase following error limit or time. Check position loop tuning.
20	Motor Encoder State Error	The motor encoder encountered an illegal transition.	<ul style="list-style-type: none"> Replace the motor/encoder. Use shielded cables with twisted pair wires. Route the feedback away from potential noise sources. Check the system grounds.
		Bad encoder.	Replace motor/encoder.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
21	Auxiliary Encoder state error	The auxiliary encoder encountered an illegal transition.	<ul style="list-style-type: none"> • Use shielded cables with twisted pair wires. • Route the encoder cable away from potential noise sources. • Bad encoder - replace encoder. • Check the ground connections.
		Setup time violation for Step/Direction or CW/CCW input.	Check timing of Step/Direction or CW/CCW inputs to determine if setup time requirements are being met.
22	Motor Thermal Protection Fault	The internal filter protecting the motor from overheating has tripped.	<ul style="list-style-type: none"> • Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Ultra3000 and motor. • Check tuning.
23	IPM Thermal Protection Fault	The internal filter protecting the drive from over heating has tripped.	<ul style="list-style-type: none"> • Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Ultra3000 and motor. • Check tuning.
24	Excess Velocity Error	Velocity error limit was exceeded.	<ul style="list-style-type: none"> • Increase time or size of allowable error. • Reduce acceleration. • Check tuning.
25	Sensor Not Assigned	Homing or registration motion was attempted without a sensor assigned.	Assign a sensor to a digital input.
26	User-Specified Velocity Fault	User specified velocity level was exceeded.	Increase to a less restrictive setting.
27	Axis Not Homed	Absolute positioning was attempted without homing.	Verify homing sequence.
28	Motor Parameter Error	Parameter loaded from smart encoder or received from SERCOS controller is incompatible with the drive.	<ul style="list-style-type: none"> • Select a different motor through the SERCOS controller. • Select a different motor.
29	Encoder Output Frequency Exceeded	Encoder output frequency exceeds the maximum user specified value. This only applies when the encoder output is synthesized by the drive.	<ul style="list-style-type: none"> • Increase the encoder output maximum frequency parameter. • Decrease the encoder interpolation parameter. • Increase the encoder output divider parameter.
30	Encoder Communication Fault	Communication was not established with an intelligent encoder.	<ul style="list-style-type: none"> • Verify motor selection. • Verify the motor supports automatic identification. • Verify motor encoder wiring.
31	Encoder Data	Encoder data is corrupted.	Replace the motor/encoder.
32	Sine/Cosine Encoder Frequency Limit Exceeded	Maximum frequency of the sine/cosine circuitry has been exceeded.	<ul style="list-style-type: none"> • Decrease velocity. • Use encoder with lower resolution (before interpolation).

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
33	Absolute Position Exceeds Position Rollover	<p>Motion is commanded to a position outside the position rollover range.</p> <ul style="list-style-type: none"> • An absolute index is initiated that specifies a position outside the position rollover range. • A homing cycle is initiated with the home position outside the position rollover range. • A define home is initiated with the home position outside the position rollover range. • A preset position is initiated that specifies a position outside the position rollover range. 	Set motion command to a position within the position rollover range.
34	Ground Fault	Wiring error.	Check motor power wiring.
		Motor internal ground short.	Replace motor.
		Internal malfunction.	Disconnect motor power cable from drive and enable drive with current limit set to 0. If fault remains, call your A-B representative. If fault clears, then a wiring error or motor internal problem exists.
35	Precharge Fault	Low AC input voltage.	Check input AC voltage on all phases.
		Internal malfunction.	Call your A-B representative.
36	Power Circuitry Overtemperature	Excessive heat exists in the power circuitry.	<ul style="list-style-type: none"> • Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Ultra3000 and motor. • Check tuning.
37	AC Line Loss	One or more phases of the input AC power is missing.	Check input AC voltage on all phases.
38	RESERVED		Call your local Allen-Bradley representative.
39	Self-sensing Commutation Startup Error	Motion required for self-sensing startup commutation was obstructed.	<ul style="list-style-type: none"> • Verify that there are no impediments to motion at startup, such as hard limits. • Increase self-sensing current if high friction or load conditions exist. • Check motor or encoder wiring using wiring diagnostics.
All others	RESERVED		Call your local Allen-Bradley representative.

Troubleshooting for SERCOS Drives

SERCOS Module Status LED

Use the table below for troubleshooting the SERCOS Module Status LED on your Ultra3000 (2098-DSD-xxx-SE or -HVxxx-SE).

If the SERCOS Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Normal	Drive is enabled.	Normal operation when drive is enabled.
Flashing Green	Standby	Drive is not enabled.	Normal operation when drive is disabled.
Flashing Red-Green	DC Bus Undervoltage	The DC bus voltage is low.	<ul style="list-style-type: none"> Normal operation when using auxiliary power (main AC power is not applied). When using main AC power, refer to the section <i>Error Codes</i> to continue troubleshooting.
Flashing Red	Minor fault	Drive is faulted, but the fault can be cleared.	Refer to the section <i>Error Codes</i> to continue troubleshooting.
Steady Red	Unrecoverable fault	Drive is faulted, and the fault cannot be cleared.	Contact your local Allen-Bradley representative.

SERCOS Network Status LED

Use the table below for troubleshooting the SERCOS Network Status LED on your Ultra3000 (2098-DSD-xxx-SE or -HVxxx-SE).

If the SERCOS Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Communication ready	No faults or failures.	N/A
Flashing Green	Establishing communication	System is still in the process of establishing SERCOS communication.	Wait for steady green LED status.
		Node address setting on the drive module does not match SERCOS controller configuration.	Verify proper node switch setting.
Flashing Red	No communication	Loose fiber optic connection.	Verify proper fiber optic cable connections.
		Broken fiber optic cable.	Replace fiber optic cable.
		Receive fiber optic cable connected to SERCOS transmit connector and vice versa.	Check proper SERCOS fiber optic cable connections.

Troubleshooting for DeviceNet Drives

DeviceNet Module Status LED

Use the table below for troubleshooting the DeviceNet Module Status LED on your Ultra3000 (2098-DSD-*xxx*-DN, -*xxx*X-DN, -HV*xxx*-DN, or -HV*xxx*X-DN).

If the Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	Not powered	No power	There is no power going to the device.
Steady-Green	Operational	Normal operation	Normal operation - no action needed.
Flashing-Green	Device is in stand-by	Processing or waiting for input	Normal operation - no action needed.
Flashing-Red	Recoverable fault	Not operational	Power cycle or reset the drive.
Steady-Red	Unrecoverable fault	Drive problem	1. Check drive for power-up error. 2. Replace drive.
Flashing-Red/Green	Self testing	Self-test in progress	The device is in self test, wait.

DeviceNet Network Status LED

Use the table below for troubleshooting the DeviceNet Network Status LED on your Ultra3000 (2098-DSD-*xxx*-DN, -*xxx*X-DN, -HV*xxx*-DN, or -HV*xxx*X-DN).

If the Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Off	<ul style="list-style-type: none"> Not powered Not on-line 	<ul style="list-style-type: none"> No power going to the device Failed Duplicate MAC ID check 	<ol style="list-style-type: none"> Check the Module Status LED to verify that the drive is powered. Check that one or more nodes are communicating on the network. Check that at least one other node on the network is operational and the data rate is the same as the drive.
Flashing-green	<ul style="list-style-type: none"> On-line Not connected 	<ul style="list-style-type: none"> Passed Duplicate MAC ID check No connection established 	No action is needed. The LED is flashing to signify that there are no open communication connections between the drive and any other device. Any connection (I/O or explicit message) made to the drive over DeviceNet will cause the LED to stop flashing and remain Steady-ON for the duration of any open connection.
Steady-green	<ul style="list-style-type: none"> On-line Connected 	One or more connections established	No action needed. This condition is normal.
Flashing-red	<ul style="list-style-type: none"> On-line Time-out 	I/O connection timed out	<ol style="list-style-type: none"> Re-initiate I/O messaging by the master controller. Reduce traffic or errors on the network so that messages can get through within the necessary time frame.
Steady-red	Network Failure	<ul style="list-style-type: none"> Failed Duplicate MAC ID check Bus-off 	<ol style="list-style-type: none"> Ensure that all nodes have unique addresses. If all node addresses are unique, examine network for correct media installation. Ensure that all nodes have the same Data Rate.

Node Problems

Give particular attention to the task of setting initial addresses and data rates. Survey the network to ensure all assignments are known. Some nodes can be logically assigned to a group of devices, but physically located away from those devices. One incorrect node can cause other nodes to appear to be Bus-off (Steady-Red LED). If a node goes Bus-off and the device is reset only to go Bus-off again, the problem is likely not with the device, but rather the setting of the address, data rate, or a network-wide problem related to topology, grounding, intermittent power/data connections, or electrical noise. If a scanner goes Bus-off, nodes will not reallocate (Flashing-green or red) even if they are functioning correctly.

Device Failure - LED Status Check

A Steady-Red Module Status LED can mean an error. If the Network Status LED goes Steady-Red at power-up, it could mean there is a Duplicate MAC ID. The user response is to test all devices for unique addresses. If a Steady-Red LED remains on after the Duplicate MAC ID test shows all devices to have a unique node address, it means a Bus-off error. Do the following:

- 1.** Check data rate settings.
- 2.** If symptom persists, replace node address (with another address and correct data rate).
- 3.** If symptom persists, replace tee tap.
- 4.** If symptom persists, check topology.
- 5.** If symptom persists, check power for noise with oscilloscope or power disturbance analyzer.

Scanner Problems

If using a scanner, check the scan list, data rate, and addresses of devices. Verify series and revision of the scanner is the latest. If the scanner is Bus-off, recycle the 24V supply and then reset the scanner. If the scanner goes Bus-off again, the problem is some combination of:

- Defective node device
- Incorrect node data rate
- Bad network topology
- Faulty wiring
- Faulty scanner
- Faulty power supply
- Bad grounding
- Electrical noise

Power Supply Problems

If a single power supply is used, add up the current requirements of all devices drawing power from the network. This total should be considered the minimum current rating in selecting the power supply used. In addition check the:

- Length and current level in trunk and drop cables
- Size and length of the cable supplying power to the trunk
- Voltage measured at the middle and ends of the network
- Noise in network power measured with an oscilloscope

Cable Installation and Design Problems

Cable installation and design refers to the physical layout and connections on the network. Walk the network if possible to determine the actual layout and connections. Network management software displays only a logical record of the network. Ensure that you have a diagram of the physical layout and a record of the information from the tables below.

Cable Checks	Power Checks
Number of nodes.	Break the earth ground of the V- and Shield and verify >1.0 Mohm to frame ground with power supply off.
Individual drop lengths.	Use a multi-meter to check for short circuit between CAN_H and CAN_L, or CAN (H or L) to Shield, V- or V+.
Branched drop length.	Total power load and at its distribution points.
Cumulative drop length.	Spot check power for noise.
Total trunk length.	
Power supply cable length and gauge.	
Terminator locations and size.	

Adjusting the Physical Network Configuration

Ways to improve the efficiency of your physical network configuration include:

- Shortening the overall length of the cable system
- Moving the power supply in the direction of an overloaded cable section
- Moving devices from an overloaded cable section to a less loaded section
- Moving higher current loads closer to the power supply
- Adding another power supply to an overloaded network
- Moving the power supply from the end to the middle of the network

Interconnect Diagrams

Chapter Objectives

This appendix contains the following interconnect diagrams:

- Ultra3000 to ControlLogix cable and interconnect diagrams
- Ultra3000 drive and motor cable combinations
- Ultra3000 connector pin-outs

Note: For additional wiring diagrams, refer to the *Ultra3000 Digital Servo Drives Installation Manual* (publication 2098-IN003x-EN-P).

Ultra3000 to ControlLogix Cable and Interconnect Diagrams

This section provides information to assist you in wiring the 1756-M02AE servo module when connecting the 2090-U3AE-D44xx control interface cable to your Ultra3000.

Figure A.1
2090-U3AE-D44xx Cable

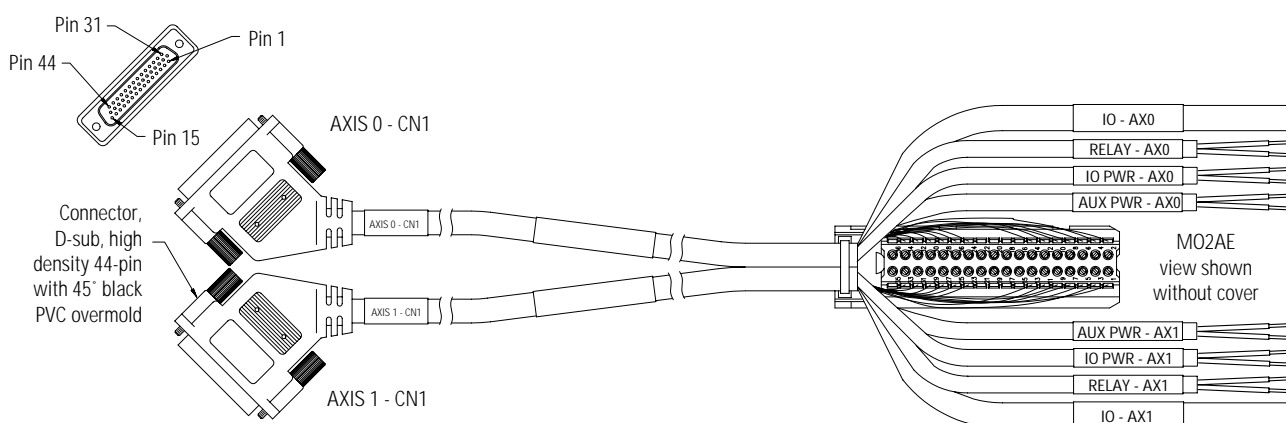
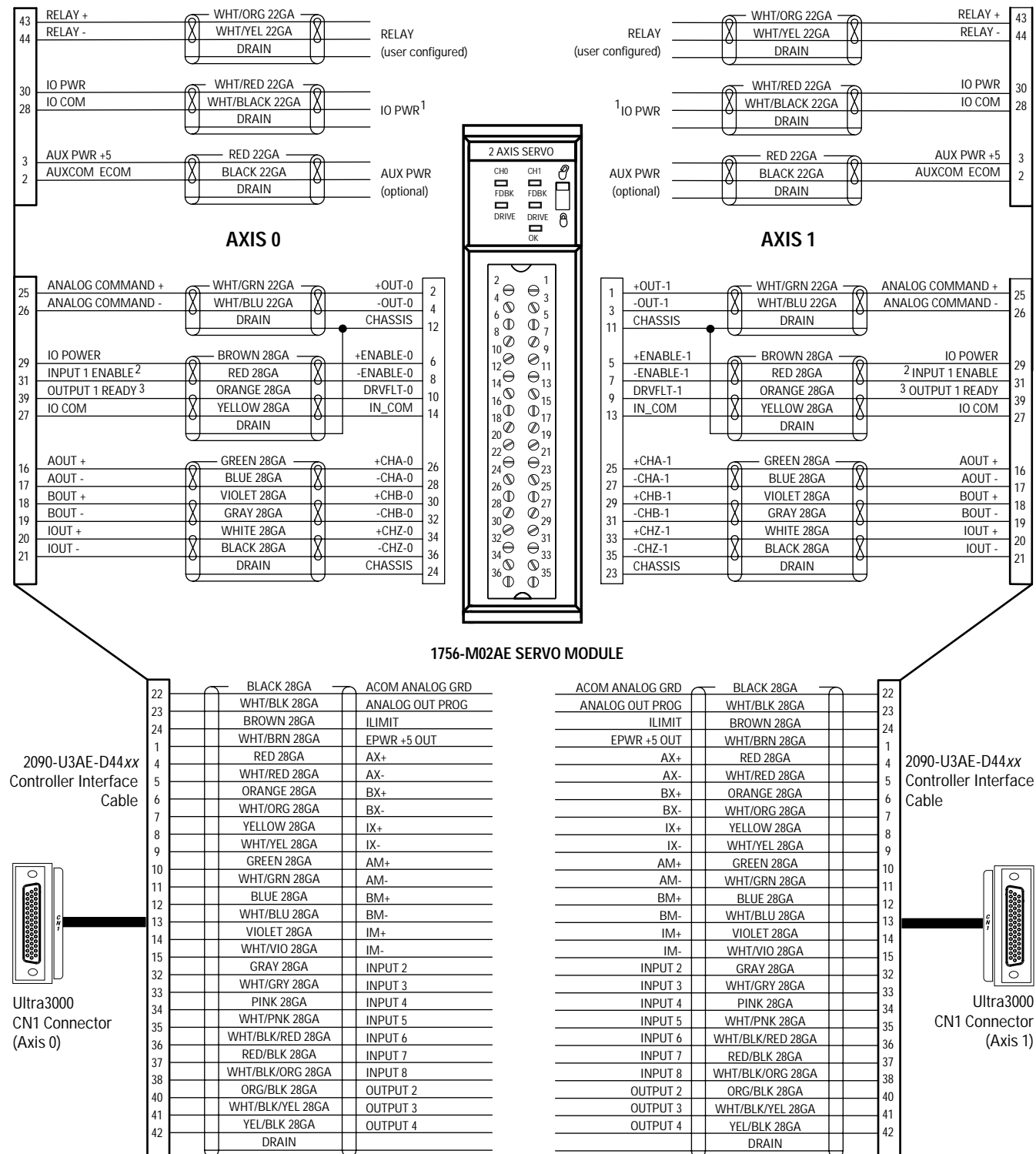


Figure A.2
Ultra3000 to ControlLogix Servo Module Interconnect Diagram



¹ I/O power (pins 28 and 30) must be connected to user-supplied 12-24V dc.

² Input 1 (pin 31) must be configured as Drive Enable using Ultraware software.

³ Output 1 (pin 39) must be configured as Ready using Ultraware software.

Ultra3000 Drive and Motor Cable Combinations

The figure below describes the motor power, feedback, and interface cables you will need for your specific Ultra3000 and motor combination.

Figure A.3
Ultra3000 Motor/Drive Cable Connections

Motor Power Cables

500W, 1 kW, 2 kW Ultra3000 to H-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to H-Series Motors
 15 kW Ultra3000 to H-Series Motors
 15 kW Ultra3000 to H-Series Motors
 2 or 3 kW Ultra3000 to H and F-Series Motors
 2 or 3 kW Ultra3000 to H and F-Series Motors
 7.5 kW Ultra3000 to H and F-Series Motors
 7.5 kW Ultra3000 to H and F-Series Motors
 15 kW Ultra3000 to H and F-Series Motors
 15 kW Ultra3000 to H and F-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to MP-Series Motors
 2 or 3 kW Ultra3000 to MP-Series Motors
 7.5 kW Ultra3000 to MP-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to N-Series Motors
 500W, 1 kW, 2 kW Ultra3000 to Y-Series Motors

Catalog Number

2090-UXNPAH-16Sxx
 2090-UXNPAH-16Rxx
 2090-UXNPAH-6Sxx
 2090-UXNPAH-6Rxx
 2090-UXNPAHF-14Sxx
 2090-UXNPAHF-14Rxx
 2090-UXNPAHF-10Sxx
 2090-UXNPAHF-10Rxx
 2090-UXNPAHF-8Sxx
 2090-UXNPAHF-8Rxx
 2090-UXNPAMP-16Sxx
 2090-UXNPAMP-14Sxx
 2090-UXNPAMP-10Sxx
 2090-UXNPAN-16Sxx
 2090-UXNPAN-16Rxx
 2090-UXNPAY-16Sxx

Feedback Cables

Ultra3000 CN2 port to H-Series Motors, RA
 Flying Leads on drive-end to H-Series Motor, RA
 Ultra3000 CN2 port to H and F-Series Motors
 Flying Leads on drive-end to H and F-Series Motor
 Ultra3000 CN2 port to H and F-Series Motors, RA
 Ultra3000 CN2 port to H and F-Series Motors, RA, skewed
 Ultra3000 CN2 port to MP-Series Motors
 Flying Leads on drive-end to MP-Series Motor
 Ultra3000 CN2 port to N-Series Motors
 Flying leads on drive-end to N-Series Motors
 Ultra3000 CN2 port to N-Series Motors, RA
 Flying leads on drive-end to N-Series Motors, RA
 Ultra3000 CN2 port to N-Series Motors, RA, skewed
 Ultra3000 CN2 port to N-Series Motors, RA, skewed
 Flying leads on drive-end to N-Series Motors, RA, skewed
 Ultra3000 CN2 port to Y-Series Motors
 Flying Leads on drive-end to Y-Series Motor
 CN2 Break Out Board Kit (see description on page C-5)
 CN2 drive mounted Break Out Board
 Drive Feedback Cable (CN2) to flying leads, straight

Catalog Number

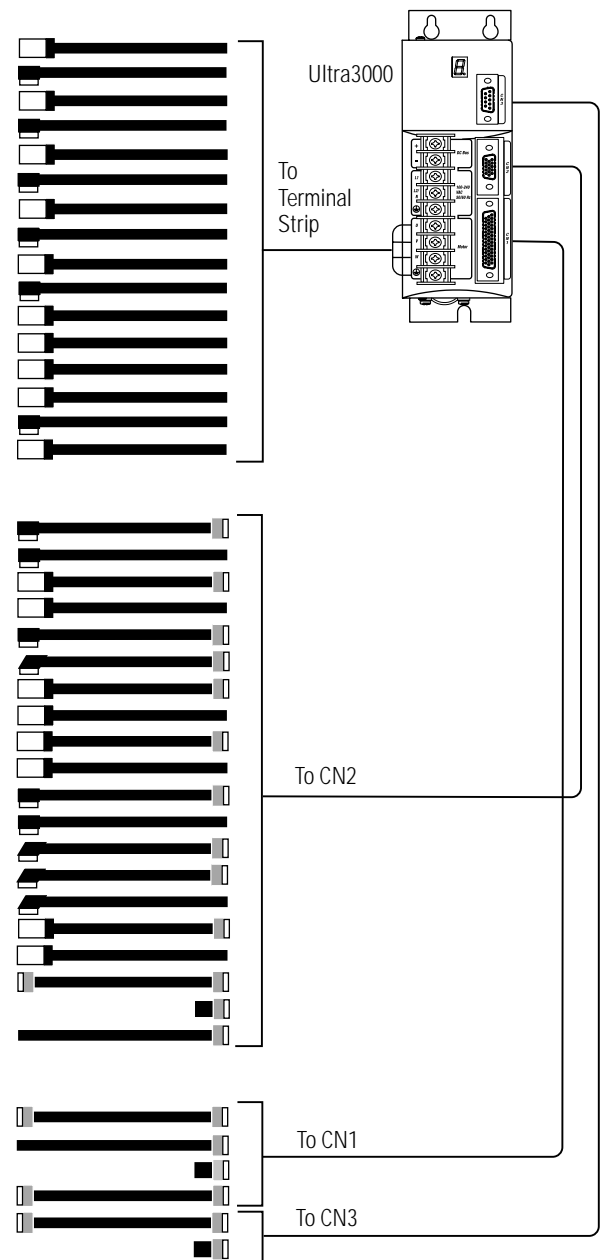
2090-UXNFBH-Rxx
 2090-UXNFDH-Rxx
 2090-UXNFBHF-Sxx
 2090-UXNFDHF-Sxx
 2090-UXNFBHF-Rxx
 2090-UXNFBHF-Kxx
 2090-UXNFBMP-Sxx
 2090-UXNFDMP-Sxx
 2090-UXNFBN-Sxx
 2090-UXNFDN-Sxx
 2090-UXNFBN-Rxx
 2090-UXNFDN-Rxx
 2090-UXNFBN-Kxx
 2090-UXNFDN23-Kxx
 2090-UXNFBY-Sxx
 2090-UXNFDY-Sxx
 2090-UXBK-D15xx
 2090-UXBB-DM15
 2090-UXNFM-Sxx

Interface Cables

Ultra3000 CN1 Break Out Board Kit (see page C-5)
 Ultra3000 CN1 port to no connector
 Ultra3000 CN1 drive mounted Break Out Board
 Ultra3000 CN1 port to ControlLogix servo module
 Ultra3000 CN3 serial port to personal computer
 Ultra3000 CN3 drive mounted Break Out Board

Catalog Number

2090-U3BK-D44xx
 2090-U3CC-D44xx
 2090-U3BB-DM44
 2090-U3AE-D44xx
 2090-UXPC-D09xx
 2090-UXBB-DM09



Length of cable xx is in meters; 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 Connector Pin-outs

This section provides pin-outs for the Ultra3000 CN1, CN2, and CN3 connectors.

I/O Connector (CN1) for SERCOS Drives

The following table provides the signal descriptions and pin-outs for the CN1 I/O (44-pin) connector. This table applies to Ultra3000 SERCOS interface drives (2098-DSD-*xxx*-SE and -HV*xxx*-SE).

CN1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In (+5V) ¹	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A-	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

CN1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2
35	Reserved	–
36	Reserved	–
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Reserved	–
40	Reserved	–
41	Reserved	–
42	Reserved	–
43	Brake Relay Output+	BRAKE+
44	Brake Relay Output-	BRAKE-

¹ CN1 (pin 3) is Auxiliary Logic Power In (+5V) for the Ultra3000 drives (2090-005x-xx, -010x-xx, and -020x-xx). For all other Ultra3000 drives this pin is reserved.

I/O Connector (CN1) for Non-SERCOS Drives

The following table provides the signal descriptions and pin-outs for the CN1 I/O (44-pin) connector. This table applies to Ultra3000 drives (2098-DSD-xxx, -xxxX, -xxx-DN, -xxxX-DN, -HVxxx, -HVxxxX, -HVxxx-DN, and -HVxxxX-DN).

CN1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In (+5V) ¹	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A-	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder Ch B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

CN1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

¹ CN1 (pin 3) is Auxiliary Logic Power In (+5V) for the Ultra3000 drives (2090-005 x-xx, -010x-xx, and -020x-xx). For all other Ultra3000 drives this pin is reserved.

Motor Encoder Connector (CN2) for 500W, 1 kW, and 2 kW Drives

The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector. This table applies to Ultra3000 drives (2098-DSD-005 x - xx , -010 x - xx , and -020 x - xx).

CN2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Reserved	–
8	Commutation Channel S3	S3

CN2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR
15	Negative Overtravel Limit	-LIMIT

Motor Encoder Connector (CN2) for all other Drives

The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector. This table applies to Ultra3000 drives (2098-DSD-030 x - xx , -075 x - xx , -150 x - xx , -HV xxx - xx , and -HV $xxxX$ - xx).

CN2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

CN2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Serial Port Connector (CN3)

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector. This table applies to all Ultra3000 drives.

CN3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	—
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	—

A

- absolute feedback range
 - exceeded 2-3
- absolute position exceeds
 - position rollover 2-6
- address
 - logically assigned 2-9
 - physically assigned 2-9
- auxiliary encoder error,
 - see* troubleshooting
- axis not homed 2-5

B

- bus
 - overvoltage 2-4
 - undervoltage 2-3
- bus-off
 - LED red 2-9

C

- cables
 - Ultra3000 drive and motor
 - cable combinations A-3
- channel AM line loss 2-3
- channel BM line loss 2-3
- commissioning your Ultra3000
 - 1-1
 - applying power 1-7, 1-34, 1-44
- configuring 1-3, 1-8, 1-23, 1-39
 - drive detection 1-8
 - drive with DeviceNet 1-43
 - drive with SERCOS 1-28
 - Ultraware software 1-8
- contents of manual P-2
- conventions used in this manual
 - P-3
- cumulative drop length 2-11

D

- data rate
 - rotary switch 1-28, 1-43
- dc bus undervoltage 2-7
- DeviceNet
 - configuration 1-43
 - module status LED 1-44
 - network status LED 1-45
- digital I/O not working correctly
 - 2-2
- drop length design 2-11

E

- efficiency, network 2-11
- electrical noise 2-9, 2-10, 2-11
- encoder communication fault 2-5
- encoder data 2-5
- encoder output frequency
 - exceeded 2-5
- error codes and messages 2-2
- excess position error 2-4
- excess velocity error 2-5

F

- front panel connections 1-4, 1-5,
 - 1-6, 1-24, 1-25, 1-26, 1-27,
 - 1-39, 1-40, 1-41, 1-42
- 2098-DSD-005, -005X, -010,
 - 010X, -020, and -020X 1-3
- 2098-DSD-005-DN, -005X-DN,
 - 010-DN, -010X-DN,
 - 020-DN, and -020X-DN
- 1-39
- 2098-DSD-005-SE, -010-SE, and
 - 020-SE 1-24
- 2098-DSD-030 and -030X 1-4
- 2098-DSD-030-DN, and
 - 030X-DN 1-40
- 2098-DSD-030-SE 1-25
- 2098-DSD-075, -075X, -150,
 - and -150X 1-5
- 2098-DSD-075-DN, -075X-DN,
 - 150-DN, and -150X-DN
- 1-41
- 2098-DSD-075-SE and -150-SE
 - 1-26
- 2098-DSD-HVxxx and HVxxxX
 - 1-6
- 2098-DSD-HVxxx-DN and
 - HVxxxX-DN 1-42
- 2098-DSD-HVxxx-SE 1-27
- with SERCOS 1-3, 1-23, 1-39

H

- hardware overtravel (SERCOS
 - only 2-3
- home position in limit 2-4
- home search failed 2-4

I

- illegal hall state 2-4

- interconnect diagrams
 - Ultra3000 drive and motor cable combinations A-3
- intermittent power 2-9
- introduction P-1
- IPM fault, *see* troubleshooting
- IPM thermal protection fault, *see* troubleshooting

L

- LED
 - logic power 1-7, 1-34, 1-44
 - module status 1-34, 1-44
 - module status (DeviceNet) 2-8
 - module status (SERCOS) 2-7
 - network status 1-35, 1-45
 - network status (DeviceNet) 2-8
 - network status (SERCOS) 2-7
 - SERCOS, 1756-M08SE 1-35
 - status 1-7, 1-34, 1-44
 - status check 2-9
- logic power LED 1-7, 1-34, 1-44, 2-2

M

- MAC ID 2-9
- maintenance
 - cleaning 2-1
 - inspecting cables 2-2
 - periodic 2-1
 - troubleshooting 2-2
- minor fault 2-7
- module status LED 2-7, 2-8
- module status LED (DeviceNet) 1-44
- module status LED (SERCOS) 1-34
- motor encoder error 2-4
- motor jumps when first enabled 2-2
- motor overtemperature 2-3
- motor parameter error 2-5
- motor thermal protection fault 2-5
- motors
 - testing 1-19, 1-36
 - tuning 1-19, 1-36
- MSD and LSD
 - rotary switch 1-28, 1-43

N

- network
 - network status LED 2-9
- network status LED 1-35, 1-45
- network status LED (DeviceNet) 2-8
- network status LED (SERCOS) 2-7
- network, efficiency 2-11
- no communication 2-7
- non-volatile memory endurance exceeded 2-3
- number of nodes 2-11

O

- overspeed fault 2-4

P

- pin-outs
 - motor encoder connector A-6
 - serial connector A-7
- power
 - applying power 1-7, 1-34, 1-44
- power (PWR) indicator not on 2-2
- precautions
 - general startup 1-1
- purpose of this manual P-1

R

- related documentation
 - Controllogix motion module programming manual P-2
 - ControlLogix motion module setup and configuration manual P-2
 - DeviceNet cable system planning and installation manual P-2
 - ICP 8 axis SERCOS interface module installation instructions P-2
 - Logix5000 controller motion instruction set reference manual P-2
 - Ultra3000 DeviceNet reference manual P-2
 - Ultra3000 with DeviceNet reference manual 1-45

- Ultraware CD installation
 - instructions P-2
- Ultraware user manual P-2
- rotary switch
 - data rate 1-28, 1-43
 - MSD and LSD 1-28, 1-43

S

- scanner
 - faulty 2-10
 - grounding 2-10
 - troubleshooting 2-10
- sensor not assigned 2-5
- SERCOS
 - configuration 1-28
 - module status LED 1-34
 - network status LED 1-35
- setting
 - address 2-9
 - baud rate 2-9
 - data rate 1-28, 1-43
 - node address 1-28, 1-43
- software overtravel (SERCOS only) 2-4
- start-up procedure 1-1
- status LEDs 1-7, 1-34, 1-44, 2-2
- storage
 - responsibility P-3
- support
 - local product P-4
 - technical product assistance P-4

T

- tee tap 2-9
- testing axes
 - hookup tab 1-20, 1-36
 - servo tab 1-19
- troubleshooting 2-2
 - cable installation and design 2-11
 - device failure 2-9
- DeviceNet
 - module status LED 2-8
 - network status LED 2-8
- error codes 2-2
- general
 - absolute feedback range exceeded 2-3
 - absolute position exceeds

- position rollover 2-6
- auxiliary encoder error 2-5
 - axis not homed 2-5
- bus undervoltage 2-3, 2-4
- channel AM line loss 2-3
- channel BM line loss 2-3
- digital I/O not working correctly 2-2
- encoder communication fault 2-5
- encoder data 2-5
- encoder output
 - frequency exceeded 2-5
- excess position error 2-4
- excess velocity error 2-5
- hardware overtravel (SERCOS only) 2-3
- home position in limit 2-4
- home search failed 2-4
- illegal hall state 2-4
- IPM fault 2-3
- IPM thermal protection fault 2-5
- motor encoder error 2-4
- motor jumps when first enabled 2-2
- motor overtemperature 2-3
- motor parameter error 2-5
- motor thermal protection fault 2-5
- non-volatile memory
 - endurance exceeded 2-3
- overspeed fault 2-4
- power (PWR) indicator not on 2-2
- sensor not assigned 2-5
- software overtravel (SERCOS only) 2-4
- user-specified current fault 2-4
- user-specified velocity fault 2-5
- velocity exceeds position rollover /2 2-3

- grounding 2-9
- module status LED 2-7
- node address problems 2-9
- physical network configuration

- 2-11
- power supply 2-10
- scanner 2-10
- SERCOS
 - module status LED 2-7
 - network status LED 2-7
- troubleshooting your Ultra3000
 - 2-1
- trunk length 2-11
- trunk wiring 2-10
- tuning axes
 - tune tab 1-21, 1-37

U

- Ultra3000 with DeviceNet
 - Reference Manual 1-45
- Ultraware software 1-8
- unrecoverable fault 2-7
- user-specified current fault 2-4
- user-specified velocity fault 2-5

V

- velocity exceeds position rollover
 - /2 2-3

W

- who should use this manual P-1

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